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The Colorado Convention.

The Colorado Electric Light, Power & Railway Association took up in its convention last week many problems of interest to central-station and power-transmission men the country over, as well as some special Colorado problems. Among the latter the "Colorado brand" of lightning came in for its share of attention. The mountain and foot-hill regions of Colorado have been recognized as badly afflicted in this respect ever since electric circuits were strung in that country. As President Tripp indicated in his address, Colorado is fast becoming a state of big power companies and transmission lines. It has had notable examples for some years of both water-power plants and steam plants located at the coal mines, and is soon to have still more notable examples. The Central Colorado Power Company is engaged on some mammoth water-power development work and on plans for very long distance transmissions on steel-tower lines over mountain ranges at 90,000 volts. The plant of the Northern Colorado Power Company, which the convention visited in a body, is a good example of a type of plant much talked about but seldom built, namely, one located at the mouth of a coal mine. Not the least interesting feature of this latter plant as far as many small companies are concerned, is the plan to run, below the transmission line, for its entire length, a 2300-volt line for farmers and other small power users.

In the commercial and business building end of central-station work the Colorado convention is fortunate in having in its membership the Denver Company which always has something interesting going on in revenue-increasing methods, and does not seem by any means to have reached the saturation point in its territory. Considerable convention time was given to commercial topics, and one evening was devoted to the incandescent lamp outlook. Owing to the distance of Denver, it has been impossible to get more than an outline of the work done by the convention in this issue, but further reports properly classified for convenient reading and reference will appear in later issues, and will be found full of meat.

Calculation of Wire Spans.

The determination of the proper span data for a transmission line is not a matter of easy calculation if the effect of all the factors entering are to be rigorously taken into account, owing to the complication of the formulas. And since the building of such lines has become a branch of engineering instead of merely lineman's work, as was too often the case in the past, it is desirable to have the technics of the subject placed in a condition similar to that of other branches of engineering. In our issue of Jan. 12, of this year, an article by Dr. Harold Render presented a relatively simple formula for the relations between deflection, tension and temperature in

wire spans, based upon a thorough analysis of these relations published by Dr. Cary T. Hutchinson in 1899. On page 604 of this issue we print another contribution by Dr. Render to the subject, in which a further simplification is made by recourse to a graphical method. By means of two charts—one for long and the other for short spans—and with the addition of simple numerical computations of certain values with which to enter an accompanying table, the tension and corresponding sag can be determined at which a cable should be strung at a normal temperature to comply with a given tension at a limiting temperature, and also similar data on the assumption that the cable is loaded with a given coating of sleet and subject to a given wind velocity. While the charts as presented apply only to copper conductors, similar ones can be easily constructed for a different wire conductor.

The Problems of a Small Plant.

It is instructive to consider the impartial way in which engineering problems arise with equal insistance in all sorts of cases. The little Swedish plant which we describe in the current issue is as valuable an example of clever and resourceful engineering as has appeared in many a day, and incidentally sets a standard of economical construction very hard to live up to there or anywhere else. It is a case of a relatively small power utilized with discriminating care and scrupulous regard to low fixed charges. Plants of this size are hard to put through in this country save as private investments, for there is no room for "financing" at a total cost of $52.70 per kw at the station. One would find himself a voice crying in the wilderness if he tried to interest an American banker in a $50,000 plant installed on any such basis. Nevertheless, in Sweden there was enterprise enough to put in the plant and we hope later to hear the expected good things of the returns on the investment. Apparently the hydraulic situation was of a very remarkable character, allowing an effective development at extraordinarily low cost. When it came to the 10,000-volt line, however, the situation was less favorable and a nice balance had to be struck between going around, over, or under an estuary. As has frequently happened, a long span proved the best way out of the difficulty, so a long span went up, with a factor of safety, by the way, of five, which seems ample for the purpose. The construction of the span seems very simple and effective, and the factor of safety in the strain insulation is up to 6.6, the neutral points of the star-connected line being grounded.

One of the interesting features of the plant is the distribution, which is three-phase for a motor district near the transformer station and direct-current, three-wire in the lighting network, evidently to suit the existing wiring. The transformation to direct current is by motor-generators, the old steam-driven, direct-current generators thereby serving as a reserve, while a storage battery furnishes an effective temporary resource. It is worth noting that the direct-current enclosed arc at 7 amperes worked 2 in series across the mains has been adopted for the street lighting. Small as is Westerwek (there are only 65 street lamps the whole direct-current system is of underground cables. We note that on the line the water stream form of static protector is in use, and we hope that later details of its performance under various conditions may be obtained. The device is one considerably used abroad in various forms, but it has never been a favorite with American engineers, and there seems to be no general consensus of opinion as to its merits. It should certainly act as a relief on the line, but what its performance would be in case of a heavy lightning discharge or a formidable surge is somewhat doubtful. Altogether, this small plant is an admirable example of recent practice and shows how effectively a small water-power can be put to work for the supply of a small market. The world is full of such chances, though seldom capable of so economical utilization. Yet there are many American streams worth an attempt to develop in very similar fashion, and hence the particular value of this example. The trouble in this country at present is that the smaller chances are often overlooked, and attention is directed chiefly to large enterprises regardless of the fact that they very commonly present much less favorable chances for cheap utilization, and generally involve long transmissions. It would prove profitable to investors hereafter to keep a much sharper outlook than formerly for opportunities like that at Westerwik.

Magnetic Hysteresis Phenomena.

One frequently encounters the statement that the core flux in a stationary transformer is produced by the combined magnetizing action of the primary and secondary currents. Such a statement is not inaccurate in itself, but beyond doubt it frequently leads to incorrect assumptions by persons not thoroughly familiar with the internal actions of the transformer. Thus, the above statement may lead one to conclude that the currents are the independent variables and that the flux is forced to assume such value as the resultant current is able to produce in the core reluctance. That is to say, one initially unfamiliar with transformers would be justified in assuming from the statement above that, if under certain operating conditions, the core reluctance were suddenly increased, the flux would be proportionately decreased. It is well known that the value of the core flux is determined solely by the required value of the counter e. m. f. in the primary coils; the current is the dependent variable and it must have such a value that at each instant its magnetomotive force produces the instantaneous flux demanded by the counter e. m. f.

It is to the conditions here outlined that may be attributed the increase in the primary current with increase in the secondary current of the transformer. The value of the secondary current is determined solely by the relation between the internally generated secondary e. m. f. and the total impedance of the secondary circuit. The primary current under load must have a value such that its magnetomotive force at each instant is sufficient to counterbalance the magnetomotive force of the secondary load circuit, and also to supply additional magnetomotive force to produce the required core flux in the reluctance of the magnetic path. When a constant-potential stationary transformer is operated with open secondary circuit, the primary current wave of time-value is peaked, on account of the cyclic change in the reluctance of the magnetic path; moreover, the current has a less value when the magnetism is decreasing than when it is increasing, on account of the so-

called "hysteresis" phenomena. The lag of the change in reluctance behind the change in the magnetizing force is a condition effect and not a time effect. That is to say, when the magnetism is taken throughout a certain cycle of change, the reluctance is the same at each relative condition of change in magnetism, whether the cycle be completed very slowly or with extreme rapidity.

An article by Mr. M. O. Bolser, on page 603 of this issue, describes an interesting device for showing the cyclic change in reluctance when a portion of a transformer core is revolved synchronously with the alternation of the flux, the equipment being similar to the one discussed by Dr. Steinmetz in his "Alternating Current Phenomena." On account of the fact that at all speeds below synchronism the cyclic change in the reluctance of the total flux path is unaffected by the speed, the apparent "hysteresis" loop is the same at all such speeds. However, the actual hysteresis loss in the rotor decreases with increase of speed, the result being that the rotor exerts at all speeds a constant torque having such a value that when expressed in synchronous watts it is just equal to the actual hysteresis loss in the rotor when stationary. When the speed is above synchronism the cyclic change in the reluctance of the rotor is such that the required primary current is less when the magnetism threading the primary coil is increasing than when it is decreasing. Thus the apparent "hysteresis" loop indicates that the rotor is giving out energy instead of absorbing it. That is to say, the machine is operating as a generator. The machine may operate at exact synchronism with any torque from the full motor value (corresponding to the stationary hysteresis loss in synchronous watts), through zero (under which condition the apparent "hysteresis" reduces to zero) to the full generator value at which the apparent "hysteresis" becomes negative. The conditions at exact synchronism are discussed in detail by Mr. Bolser in the article which appears in this issue.

RECENT HIGH-SPEED GERMAN PRINTING TELEGRAPHS.

In Germany, the Hughes printing telegraph has retained for many years its ascendancy. The same instrument was at one time largely used in Great Britain and also to a lesser extent in the United States. At present, the apparatus is almost limited to Germany. Messages are transmitted from a manual keyboard, somewhat like that of a pianoforte, and are printed at the receiving end in Roman type upon a paper tape. The gist of the system, as is well known, consists in maintaining synchronism automatically between two revolving disks, one at each end of the line, in such a manner that the revolving disk at the receiving end, armed with type on its periphery, can strike off inked impressions at the properly selected moments on the passing paper strip. The speed of rotation is limited by electromechanical conditions to about 150 r. p. m., and to about one printed letter per revolution, or, say, 30 words per minute. The advantage of the apparatus over ordinary Morse lies in the direct printing of the message by the receiving mechanism without the need of an expert transcriber.

Within the last year or two, Messrs. Siemens & Halske, of Charlottenburg, Berlin, Germany, have brought out an improved printing telegraph machine for operating at 2000 letters per minute. Although still under experimental trial, this apparatus has been in successful commercial service for about a year on a few circuits. One of these is from Munich to Nurenburg, about 100 miles long. The message to be sent is written off on a special form of typewriter, which not only prints the message on a 1-in. strip of paper, but also perforates the same in a set of 11 rows of holes. One foot of the perforated tape holds about 110 letters. The tape is fed to an automatic transmitter, which causes for each letter one positive and one negative impulse to flow to line at the proper respective intervals. As in the Hughes apparatus, there are two rotating disks, one at each end of the line, maintained in synchronism; but the speed of rotation is about 2000 r. p. m., and a letter is sent in each revolution. In the rotating disk at the receiving end, the letters are carried in perforated Roman type. The impulses are so timed that a 20-kilovolt locally-generated spark is liberated behind this rotating disk, so as to illumine a strip of chemically prepared sensitive paper through the proper successive type perforations. The letters are thus successively photographed on the advancing paper strip, which passes through a developing trough, and then through a fixing trough. When a strip finally emerges from the chemical baths, the message in photographically printed Roman type is ready for gumming on a delivery sheet.

There is nothing remarkable in securing a speed of transmission of 400 words per minute over a short telegraph line. Such a speed is obtainable on the Wheatstone recorder, and far greater speeds have been obtained on Bain electrochemical recorders. The remarkable feature lies in producing printed Roman letters at this speed, as distinguished from Morse dots and dashes, which require expert transcription. Much ingenuity has been displayed in the photographic spark production of the receiving mechanism. Each time that a letter is printed, the spark must be produced, do its photo-chemical work, through the type-hole, on the paper strip and disappear, all within the forty-thousandth part of a second. More than 30 such letters have to be printed per second. The speed with which messages can be transmitted by such apparatus is, of course, several times as great as that of the hand Morse, and, at the same time, the expense is much less than that of the hand Morse.

In order to utilize to the fullest extent the powers of such modern type-sending and type-receiving telegraphs as this German system, the Rowland system in America or the Murray system in Great Britain, it would seem to be necessary to have a reduced tariff for telegraph messages between those head offices where such printing telegraphs can be maintained, keeping the regular tariff for all ordinary messages that have to travel over Morse lines. It is not conceivable, at present, that the Morse hand system can be superseded on the ordinary way circuit. That system has proved its complete adaptability for ordinary way traffic through half a century of practical experience. But on through lines, connecting large cities, the Morse hand system must eventually be replaced by fast printing telegraphs which are able to earn a dividend at a considerably reduced tariff per word, and which can find a largely increased traffic by the introduction of a properly reduced tariff on messages.

Power in Manufactures.

The Bureau of the Census has just issued Bulletin 88, which is a report on the power employed in manufactures. This report, which forms part of the census of manufactures of 1905, contains the statistics for the calendar year 1904, and was prepared under the supervision of Mr. William M. Steuart, chief statistician for manufactures, by Mr. Thomas Commerford Martin, expert special agent. The total power employed in manufactures, according to this report, was 14,641,544 hp. To this amount steam engines contributed 10,828,111 hp, or 73.9 per cent; water wheels, 1,647,969 hp, or 11.3 per cent; electric power, owned or rented, 1,592,483 hp, or 10.9 per cent; gas or gasoline engines, 289,514 hp, or 2 per cent; and other kinds of power, 283,467 hp, or 1.9 per cent.

When compared with the figures reported at the census of 1900, those of 1905 show that in five years the total horse-power increased more than 40 per cent. The largest relative increase for any of the kinds of power was one of 270.5 per cent reported for owned electric motors. Rented electric power increased 141.9 per cent, and the power of gas and gasoline engines, 114.9 per cent. The largest absolute increase however, was reported for steam engines, the horse-power of which increased 2,687,578, or 33 per cent. The power of water wheels increased only 13.3 per cent.

From these figures it is evident that although steam engines are by far the most important source of power, electric power and the power of gas and gasoline engines are becoming of increased relative importance in manufacturing. Waterpower, while increasing absolutely, is dimishing in comparison with other kinds of power.

Among the several geographic divisions the Middle states ranked first in the amount of power, reporting 5,000,367 hp. The Central states were second, with 4,077,298 hp; the Southern states third, with 2,386,330; the New England states fourth, with 2,254,264; the Pacific states fifth, with 474,397, and the Western states last, with 445,937. Perhaps the most striking fact revealed by these figures is that the Southern states reported more power than New England. This has not happened before in the history of the country. In this connection it is interesting to note that the development in the Southern states has been in the utilization of steam power. In the South 87.4 per cent of the power was derived from steam and 6.2 per cent from water, but in New England 59.3 per cent was from steam and 29.2 from water.

The effect of a heavy industry on the utilization of steam power is illustrated by the fact that Pennsylvania, the principal center of the iron and steel industry, reported 2,088,773 steam hp, or almost 20 per cent of the total for the whole country. Ohio reported 1,028,665, so that these two states have nearly 30 per cent of the entire steam power employed in manufactures, a fact which results largely from the use of steam power in the metal industries. New York ranked third, with 850,497 steam horse-power; Massachusetts fourth, with 690,467, and Illinois fifth, with 651,578.

A comparison of these figures with those reported at the census of 1905 shows a percentage of increase in steam horse-power of 21.6 for Pennsylvania, 40.5 for Ohio, 28.9 for New York, 19.8 for Massachuesetts and 28.4 for Illinois. As might be expected, the largest percentages of increase were shown for some of the Western States and territories, but the Southern states were also conspicuous for large increases.

The largest amount of water power used in manufactures at the census of 1905 was reported by New York. The capacity in that state increased from 335,411 horse-power in 1900 to 446,134 horse-power in 1905, giving that state 27.1 per cent of the total for the whole country. The continued leadership of New York in the use of water power is due largely to the utilization of this kind of power in the paper and wood pulp industry. Of the total water power reported by New York at the census of 1905, paper and wood pulp manufactures used 73 per cent.

The next largest utilization of water power in manufactures was reported by the state of Maine, with 203,904 horse-power, followed closely by Massachusetts, with 183,427 horse-power. Wisconsin was fourth, with 112,665 horse-power. In Wisconsin, as in Maine and New York, the paper and wood pulp industry is the largest consumer of water power, while in Massachusetts the cotton and wool industries are the largest.

As might be expected, in some of the states and territories where the aggregate of water power is least the percentage of increase has been greatest, as the addition of a few hundred horse-power has been enough to double the capacity. It is worthy of note, however, that the increase between 1900 and 1905 was 33 per cent in New York, 27.9 per cent in Maine, and 21 per cent in Wisconsin. In Massachusetts and also in Connecticut and Vermont there was virtually no further development in water power—in fact, a tendency toward retrogression is visible in certain parts of the New England region. It may be possible that the greater use of steam in some of the industries in the Northern states may be due to the fact that the water powers have already been developed to their full capacity.

At the census of 1905 power derived from electricity was reported as 1,592,483 horse-power, which represents an increase over the amount reported at the census of 1900 of 1,099,260 horse-power, or 222.9 per cent. The development was extraordinary in the states distinguished chiefly for heavy manufacturing on a large scale. The horse-power reported rose in Pennsylvania from 107,746 to 346,797, or 221.9 per cent; in New York from 77,598 to 222,111, or 186.2 per cent; in Illinois from 49,235 to 165,265, or 235.7 per cent; in Ohio from 42,157 to 144,467, or 242.7 per cent; and in Massachusetts from 32,828 to 91,017, or 177.2 per cent.

The increase in the number, size and total capacity of gas and gasoline engines has been another marked feature of industrial development. The number of gas and gasoline engines reported increased from 14,334 in 1900 to 21,525 in 1905, their horse-power from 134,742 to 289,514, and their percentage of the total horse-power employed in manufacturing establishments from 1.3 to 2. When it is recalled that at the census of 1890 the capacity of gas engines in manufacturing establishments was only 8930 horse-power and is now over 30 times as great, it will be seen that a really remarkable change has taken place.

Gas and gasoline power is used very generally throughout the country, being reported from every state and territory. Pennsylvania led in the utilization of power of this kind, reporting 68,209 horse-power; New York ranked second, with 44,288 horse-power; Ohio third, with 35,101 horse-power; Indiana fourth, with 21,171 horse-power; Illinois fifth, with 12,319 horse-power; and Wisconsin sixth, with 11,356 horse-power.

The gasoline engine is necessarily more widely used than the gas engine, as gasoline is obtainable everywhere, while the gas engine usually depends upon city gas works for its supply of fuel. Hence by far the larger number of gas engines, and those small ones, are to be found in the denser centers of population, where the engine can be employed for the countless minor or finer branches of industry. Unlike the steam engine, it can be installed practically on any floor of a building, when surrounded by appropriate safeguards against fire. It is in this respect, however, that of recent years the smaller gas engine has encountered the sharp competition of the electric motor. The latter, in many of the essentials of convenience, economy, adaptability and freedom from danger, comes into competition with the gas engine, as does that appliance with the steam engine.

Besides the power derived from steam, water, electricity, gas and gasoline, 92,154 horse-power was reported at the census of 1905 as owned by manufacturing establishments. A large part of the power included in this class is pneumatic, although probably some hot-air engines also are included. The general introduction of pneumatic tools has resulted in the installation in various shops and factories of large pneumatic plants to supply the compressed air to drive these tools.

Rented power increased from 319,475 horse-power at the census of 1900 to 632,905 horse-power at the census of 1905, or

98.1 per cent. Of the total reported at the later census, 441,592 horse-power, or more than two-thirds, was derived from electricity and has already been counted under electricity.

The effect of the introduction of electricity has been to retard the increase of other kinds of rented power. The various electric lighting companies throughout the country have found renting power a large and profitable source of income, giving them a load for their generating apparatus in the daytime. Thus they are able to run their plants at nearly the full capacity at all hours of the day and night.

Educational Work for New York Edison Employees.

There will be inaugurated, Tuesday evening, Oct. 1, by The New York Edison Company, the most far-reaching scheme of technical welfare work which has hitherto been undertaken. An experimental lecture course will be given for the benefit of the employees of The New York Edison Company under the auspices of the Association of Edison Employees, in the auditorium of The New York Edison Company, 44 West Twenty-Seventh Street. The lectures will be under the direction of Prof. Sydney W. Ashe, who had charge of the welfare work for the Brooklyn Edison Company last year. The course will include 25 weekly lectures upon electrical engineering, beginning with the elements of magnetism and extending to electrical measurements, direct and alternating currents. Each lecture will be repeated so as to give both day and evening employees an equal opportunity to attend. A very elaborate syllabus has been prepared giving dates, topics, general information about the course and detailed notes about all experiments to be performed. The lectures will be both theoretical and practical, and no expense will be spared to make them thorough and interesting, and to obtain the best results. The lectures will be given at 1:30 p. m. and 8 p. m. The company is to be congratulated upon inaugurating this work, which it is hoped will achieve the great success it deserves.

Smelting and Refining of Copper.

The Bureau of the Census has just issued Bulletin 86, which contains special reports on copper, lead and zinc smelting and refining. These reports, which form part of the census of manufactures of 1905, were prepared by Story B. Ladd, under the supervision of William M. Steuart, chief statistician for manufactures. The statistics included in the bulletin are for the calendar year 1904, with the exception of those for Michigan, which cover the year ending June 30, 1904. According to these statistics, 103 establishments were reported as engaged in the combined industry of copper, lead and zinc smelting and refining. Their combined capital was $164,349,036. They employed 26,853 wage-earners, paid $20,058,200 in wages, consumed materials costing $382,723,480, and manufactured products to the value of $451,398,354.

At the census of 1900 the lead smelting and refining industry was the most important of the three branches, and copper was second; but at the census of 1905 the positions were reversed. At the later census the copper industry supplied 46.8 per cent of the capital, 47.5 per cent of the wage-earners, and 53.3 per cent of the value of products, while the lead industry furnished 38.8 per cent of the capital, 28.2 per cent of the wage-earners, and 41.2 per cent of the value of products. That the growth of the copper industry has been greater than the growth of the lead is partially due to an increase in the smelting of dry ores of precious metals with copper instead of lead ores.

Copper smelting and refining was the principal industry of 40 establishments, the combined capital of which was $76,824,640. These establishments furnished employment to 12,752 wage-earners, paid $10,827,043 in wages, consumed materials costing $196,736,986, and manufactured products to the value of $240,780,216.

When compared with the figures for the census of 1900 those for 1905 show a decrease of 14.9 per cent in the number of establishments, but an increase of 44.8 per cent in capital, of 12.6 per cent in wage-earners, of 26.9 per cent in wages, of 61 per cent in cost of materials, and of 45.8 per cent in the value of products.

The growth of the industry, however, has not been uniform in the sections east and west of the Mississippi. The figures reveal a tendency toward the growth and concentration of the refining industry in the eastern territory. In 1900 this territory reported only 86.8 per cent of the refining, while in 1905 it reported 98.8 per cent. The operations of the western establishments are now confined almost entirely to smelting, with, in a majority of cases, the conversion of the matte into blister copper, which is electrolytically refined in the East.

New Jersey is the largest producer of refined copper, and between 1900 and 1905 it increased its production of the total for the country. Of the 602,595,113 lbs. of ingots, wire, bars, etc., reported in 1900 New Jersey produced 28.3 per cent, while of the 933,809,701 lbs. reported in 1905 it produced 35.6 per cent. The refining industry in New York also made a great advance, so that the states of New Jersey and New York reported for 1905 nearly two-thirds of the refined copper product of the country. Michigan was third and Maryland fourth.

Convention of the Colorado Electric Light, Power & Railway Association.

The Colorado Electric Light, Power & Railway Association held its fifth annual convention at Denver, Sept. 18, 19 and 20, at the Savoy Hotel. The first session was called to order about 11:30 Wednesday morning, the 18th, with Mr. George B. Tripp, of Colorado Springs, president, in the chair. After rollcall President Tripp delivered his address. He recalled the day in August, 1903, when a few met in Denver to organize the association and also the first convention held in December of the same year. There were 37 active members on the roll at the first convention. There are now 43. The number of possible active member companies in Colorado is 57. He then reviewed the benefits resulting from the organization.

The most interesting part of his address was that relating to revolutionizing changes in the power situation in Colorado about to take place and due to cheap water power being developed by some of the large power companies soon to commence operation in different portions of the state. This cheap power would, he thought, make possible much mining development otherwise impossible. He predicted that in five years there would be a 50-per cent decrease in the amount of coal used by Colorado mines and mills due to the increase of the use of hydro-electric power, and that ultimately coal will mainly be confined to domestic uses.

The executive committee recommended that Montana and the Dakotas be added to the territory embraced by the association. This territory already includes Colorado, New Mexico, Arizona, Utah, Wyoming and Idaho. This was adopted at a later session.

On Wednesday afternoon, Mr. B. E. Buttles, of the Denver Gas & Electric Company presented a paper entitled "Notes on Modern Boilers." He called attention first to the fact that boilers are not selected with the same care as engines with respect to refinements and suitability to the work in hand. He laid special emphasis on ease of cleaning and repair, and and on the difference between test conditions with new boilers and operating conditions with old ones. Tests of boiler efficiencies are likely to be confused with furnace efficiencies. That boiler will probably be kept cleanest which is easiest to get at. He criticized points about various boilers which make both internal and external cleaning difficult. Soot and dust lodged in large quantities around a boiler are likely to cause damage as well as loss of efficiency.

Mr. C. K. Durbin asked the opinion of members as to the relative merits of water-tube and horizontal return flue boilers for small electric light plants.

President Tripp said that in a small plant in Trinidad where there were boilers of both kinds, the water-tube boiler had to be kept out of service longer for cleaning and therefore in a very small plant was less desirable than in a large one.

This was followed by a paper on "Central Station Power Problems" by Mr. Chas. Robbins, of the Westinghouse Electric & Manufacturing Company. An abstract of this paper and the extended discussion following it will appear in a later issue. The convention took up, also, a number of questions from the Question Box, which will be given later.

Thursday morning was given to the reading and discussion of a paper by Mr. Geo. E. Putnam, of the Denver Gas & Electric Company, on "Business Building by Commercial Departments." Some interesting facts on recent developments in Denver in obtaining increased business from old consumers were brought out and will be given in a later issue.

Thursday evening Mr. F. W. Willcox, of the General Electric Company, presented a paper on "The Incandescent Lamp Outlook," which will appear in abstract later. The discussion on lamps lasted until a late hour.

Friday morning a very interesting and profitable meeting was held to discuss "Lightning Protection in Colorado." Mr. Leonard Wilson, of the General Electric Company, opened this discussion with an address describing the kinds of arresters used in Colorado and their behavior, and various members then gave their experiences. It is the purpose of the association to print this as a symposium later, after those taking part in the discussions have furnished more complete data.

Friday afternoon Mr. Frank E. Johnson read a paper on "High-Tension Porcelain Insulators." He said that up to this time the insulators on high-tension lines had been mainly of the pin-supported type. With these the limit of good and satisfactory line construction has been reached at about 60,000 volts, if top-heaviness of insulators is to be avoided and if the insulators are not to be too enormous and difficult to manufacture. The suspension type of insulator will probably be used in the future for high-voltage work because it provides sufficient insulation for use on steel towers and can be built with a sufficient factor of safety to take care of all climatic conditions. The factor of safety on a high-voltage line should be three. Insulator porcelain is made of a mixture of clay, feldspar and quartz, baked at 2000 degrees. After pressing into form the mixture is dried, then dipped into the glaze and again dried before baking. If there is too little heat it will not become vitrified and if there is too much it will be porous. Answering a question as to why there is an unglazed spot on top of every insulator, he explained that after dipping they are set bottom up, resting on the top rather than on a lower part, as on the lower part the glaze could not be spared so easily. Mr. G. R. Hall described the suspension type of insulator to be used on several steel-tower lines now being built. A question was brought up as to how often it is advisable to patrol transmission lines. Mr. Rossi, of the Northern Colorado Power Company, expected to have that company's 44,000-volt transmission system patrolled once a day. Mr. J. F. Vail, of Pueblo, had one man on 40 miles of 25,000-volt line who spent his entire time patrolling. Mr. Hall mentioned a 22,000-volt line in Pennsylvania that was patrolled twice a week.

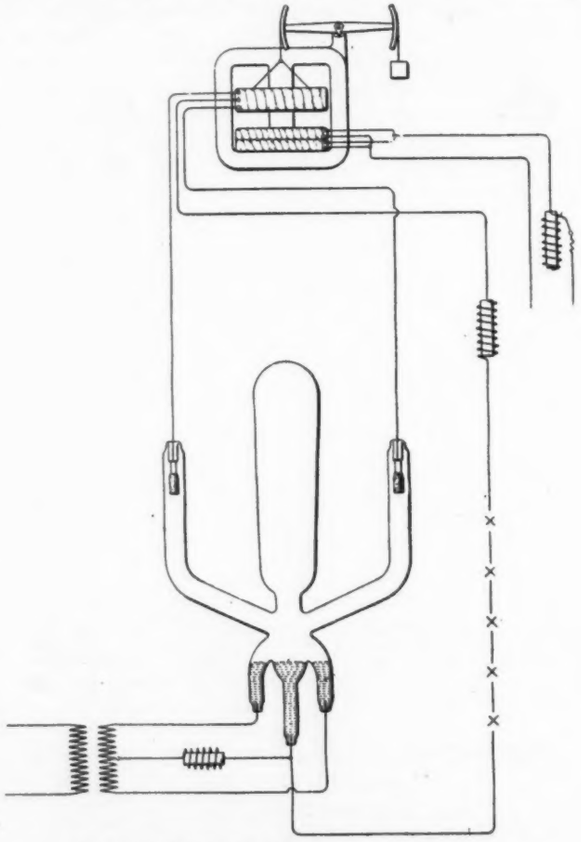
The executive and advisory committee reports were heard. The executive committee had compiled and printed the rates charged by members, for the use of member companies. The secretary and treasurer's report showed five new active members gained during the year, two lost by consolidation, and two applicants at this convention. Expenses for the year were $199.50, the balance in the treasury being $1,076. The new officers elected were as follows: President, Mr. W. G. Matthews, of the Denver City Tramway Company; vice-president, Mr. C. K. Durbin, of the United States Light & Traction Company, of Denver (controlling companies in several surrounding states); secretary and treasurer, Mr. J. F. Dostal, of the Denver Gas & Electric Company. Executive committee: Messrs. Geo. B. Tripp, W. T. Wallace and the officers. Advisory committee: Messrs. John A. Beeler, W. J. Barker, J. F. Vail, I. J. Hale and J. J. Cooper. Membership committee: Messrs. T. W. Cargo, E. P. Dillon, B. K. Sweeny. Finance committee. Messrs. V. A. Sickman, W. E. Robertson, Geo. H. Maxam.

At the close of convention a special car was provided to take delegates to visit the plants of the Denver Gas & Electric Company and the Denver City Tramway Company. On Thursday afternoon the convention took a special train to Lafayette, about 25 miles north of Denver, where the power station of the Northern Colorado Power Company is just being completed. This is a steam plant located at the coal mines for the purpose of supplying current to a number of towns in that part of the state and to operate the single-phase electric service which the Colorado & Southern (a steam road) is preparing to inaugurate. It is equipped with Parsons turbines and obtains condensing water from a lake. The transmission voltage is 44,000 and below this line the entire length, it to be a 2300-volt, three-phase circuit for supplying farmers along the line.

Wednesday evening the convention was entertained at a theater party at the Broadway Theater, where Olga Nethersole played in "The Labyrinth." Over 20 operating companies were represented at the convention, many of them sending several men. Colorado men turn out well to their conventions.

Operation of High-Voltage Constant-Current Mercury-Vapor Rectifiers.

It has been found that when a mercury vapor rectifier has been transported from one place to another there is likely to be a small quantity of mercury on or about the anodes of the tube. If this mercury is not removed before the device is put in operation at high voltage, it may cause deterioration or even



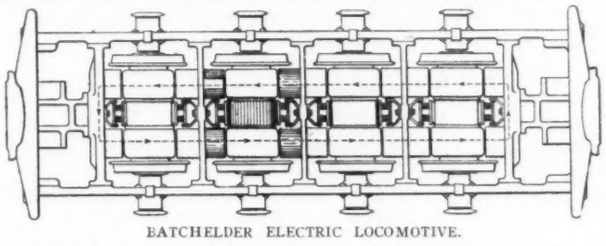
CONSTANT-CURRENT MERCURY-VAPOR RECTIFIER.

destruction of the device. Mr. Samuel Ferguson, on September 17, obtained a patent for a method of removing the mercury from the anodes of a constant-current vapor rectifier by running the device at about normal current on short circuit for a time long enough to distil off any mercury which may have collected around or in the anodes during shipment. A view of a

constant-current rectifier, to which the method is applicable is given in the accompanying illustration. The rectifier tube consists of a central chamber and side arms, and is provided with carbon anodes. These anodes are mounted near the ends of the arms and are out of the direct path of the vapor blast emanating from the mercury cathode. The vapor device is provided with the usual auxiliary or maintaining anodes and supplied with energy from a separate transformer. The main source of current for the rectifier consists of a constant current transformer of the usual form, receiving energy from constant potential mains. The load circuit of the rectifier is one or more series of arc lamps. When the equipment is operated on short circuit, or on a low load, the current heats the anodes sufficiently to distil all mercury from them, or from the spaces immediately adjacent, and the low voltage used for this treatment is small enough to avoid any danger to the tube, even though mercury be present at the beginning of the operation.

Bipolar Motor Construction for Locomotives.

The most advantageous arrangement of the field and armature members of the motors of direct-current locomotives has proved to be the one in which the magnetic flux passes through the several armatures and pole-pieces of the propelling motors and thence through the mechanical frame of the locomotive. In practice the normal cross-sectional area of the mechanical frame of a locomotive is materially less than that required for the magnetic flux, and it therefore becomes necessary either to make the locomotive frame heavier than is necessary for mechanical purposes or in some other way to add sufficient metal

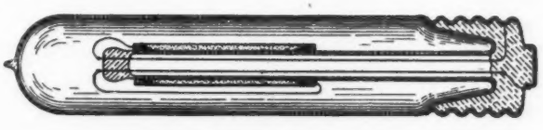


BATCHELDER ELECTRIC LOCOMOTIVE.

to give the desired area at all points in the magnetic circuit. In a patent issued Sept. 17 to Mr. A. F. Batchelder it is proposed to arrange upon each of the driving axles two armatures, each of which has its separate pole-pieces, and to connect the field coils in such a manner that the magnetic flux passes longitudinally of the locomotive through one set of armatures and pole-pieces and back again through the other set. By the above arrangement, which is illustrated in the accompanying illustration, the only portions of the frame which carry the whole flux are the cross members to which the pole-pieces at the extreme ends are attached.

Selenium Cell.

A patent issued on Sept. 17 to Mr. W. J. Hammer discloses a form of selenium cell that is robust in construction, can readily be inserted in or withdrawn from circuit, and that is stated to be permanent in its characteristics. The central



HAMMER SELENIUM CELL.

support of the selenium is a fused quartz tube covered with a thin film of aluminum, upon which the selenium is coated. The selenium is first heated to a high temperature so that it is softened to a putty-like consistency. While the selenium is in the plastic condition the tube is rolled between two plates of polished glass under moderate pressure, by which means the selenium is compacted to substantially uniform density and thickness. Upon the outer surface of the selenium there is placed a thin, transparent film of aluminum. The completed cell is sealed in a quartz tube similar in general form to an electric incandescent lamp. As shown in the accompanying illustration the two films of aluminum are used as the electrical terminals of the cell proper.

CURRENT NEWS AND NOTES.

ELECTRICAL SHOW.—As already announced, the electrical show in Madison Square Garden, New York City, will begin Monday, Sept. 30.

NORWEGIAN WATER POWERS.—The Norwegian legislature has passed restrictions upon the sales of real estate along watercourses to foreigners. Concessions of any character requiring the utilization of flowing water must first be obtained from the state authorities. Similar action is being taken in most of the countries of Europe.

PACIFIC COAST MEETING.—The Pacific Gas & Electric Association held its convention at Santa Cruz, Cal., beginning Sept. 17, at the Casino, when 75 delegates were in attendance. There were a number of papers and discussions and a good exhibit of apparatus. A banquet was given on Sept. 18, and next day the members visited the large cement works at Davenport.

THE TELEGRAPH STRIKE seems to be pretty near its end so far as it constitutes an actual factor in business and social life; but for the striking operators it must prove a serious affair as the places of many of them have been permanently filled. The Western Union Telegraph Company has removed from all its messages the reservation "subject to delay," although meantime the Railroad Commission of South Carolina has filed a decision sustaining the complaint of the Telegraphers' Union of Columbia, S. C., that the Western Union Telegraph Company is violating its charter in that state by using the United States mails for the transmission of messages filed for transmission by telegraph and upon which telegraphic tolls have been paid. The matter has been turned over to the Attorney General of the state, who is advised to institute proceedings against the Western Union if he can find sufficient law upon which to base a proceeding. This, however, does not apply to existing facts. The operators have been trying to involve newspaper and brokerage telegraphers, and again have implored the intervention of President Roosevelt but all this has been in vain, and the ocean of commercial activity has closed over the shipwrecked union.

ELECTRIC MAIL TUBES.—U. S. Vice-Consul H. M. Byington advises that a law having been passed for the institution of the electric post in Naples, Milan and Rome, the Italian minister of posts and telegraphs has nominated a commission to arrange for the opening of bids for the installation of the service. The electric post is an invention of a Neopolitan, Baron Piscicelli-Taeggi, who has also patented it in America. The invention renders possible the transmission of mail from one point to another with great speed. It is planned to reserve the electric post for the mail which has greater need of celerity, such as the transportation of special-delivery letters and local telegrams to and from the central office and the sub-stations, as well as late matter which could be sent from the central office to the railroad station 10 minutes before train time. The principal tube will be the one which connects the central office with the railroad station. If the service in the cities proves a success it is the ultimate intention to inaugurate a similar service between the principal cities in Italy. It is estimated that in this way the time between Naples and Rome can be reduced from five to two hours. It would seem that some other systems might beat this "all hollow."

ATLANTIC WIRELESS.—In an interview at Glace Bay, Nova Scotia, Mr. W. Marconi, on Sept. 23, fixed three weeks from that time as the commencement of commercial wireless business, the station on the other side being at Clifden, Ireland, where the apparatus is much more powerful than that at Poldhu, Cornwall, now to be kept as a reserve plant. The Government lines in England will handle the traffic, and on this side the Western Union and other lines will be available for message delivery.

TO CONTROL ALL WIRES.—The Public Service Commission of New York State has not hitherto had any control of telegraph and telephone companies, but is now seeking to enlarge its sphere and to secure new legislation that will give the commission power over the service given by the companies, the rates to be charged, and the capitalization of the companies, so that, although engaged in business of an entirely different character, the telephone and telegraph companies will be on the same footing in their position toward the community as the traction and lighting companies now are.

PERAMBULATING WIRELESS.—A despatch from San Francisco states that Assistant City Electrician Charles N. Farmenter of Berkeley has erected a wireless pole on the site for the new Town Hall and is experimenting with a scheme to call policemen from their beats by wireless. A simple apparatus of compact form which policemen will carry in their helmets is the means by which he hopes to revolutionize the police and fire alarm systems. Though a policeman may not understand the communications thus received, he will know that he is wanted by the ringing of the bell in his pocket. He will then hasten to the nearest police box and telephone the police station.

AMBULANCE CHASING.—At the recent annual meeting of the Philadelphia Rapid Transit Company, President Parsons said: "During the past 12 months there has been considerable criticism about the affairs of your company, much of it of a frenzied character. This in a great measure accounts for the large sums paid out in the settlement of claims, which during the past year amounted to $1,217,586, an increase of $236,266 over the previous year. Ten years ago 2½ per cent to 3 per cent took care of the accident account. To-day it is approaching 7 per cent, which is equivalent to a dividend of $2 a share upon the stock. This increase is due largely to a new enterprise which has grown up and which has been termed 'ambulance chasing.' The slightest accident is hunted up and reported by runners in the employ of lawyers of doubtful standing, many of whom are briefless except for this class of business, but who are most expert in preparing cases of this character in such a manner that they will meet the requirements of the law and catch the sympathy of the jury. There are many physicians in league with these lawyers, whose testimony is of such a nature as to exaggerate the injury and to show that any trouble the claimant may be sufferirg from might have been caused by the accident."

TELEPHONY IN NEW ENGLAND.—The Massachusetts Highway Commission has made public a letter to President Sherwin, of the New England Telephone & Telegraph Company, including recommendations made as a consequence of testimony and facts brought out. The recommendations follow: 1. Discontinuance of furnishing frank books except to officers and employees of the telephone company and to officers of other telephone companies. 2. Discontinuance of furnishing free telephones except to officers and employees of the company, charitable institutions and such as may be necessary for maintenance of the plant. 3. That quarterly reports to the commission be made, containing names of all persons to whom frank books, or free telephones have been furnished, said reports to be open to public inspection. 4. Adoption of the same merit system in selection of employees in underground construction of street work as apparently obtained in other departments, and consequent permanent discontinuance of employment of men through political influence who do not render an equivalent for wages. 5. Readjustment of all discounts to municipalities to a uniform basis. The commission indicates that the recommendations are the result of finding that there were improper practices, and that in some instances violations of the law were apparent.

GEORGIA WATER POWERS.—As our readers are well aware, the water powers of the Southern States are rapidly coming to rival those of New England, and their development is due in no small degree to the work of the United States Geological Survey, which has for a number of years been making systematic studies of the flow of the streams and the conditions which affect that flow. The work in Georgia has been carried on for more than a decade, during which period all the more important streams and many of the lesser ones have been measured many times, and records have been kept of daily, monthly and seasonal variations in their flow. Most of the data thus collected have been published from time to time, but so many of the reports are out of print or otherwise inaccessible that Messrs. B. M. Hall and M. R. Hall, who have had charge of the work, have assembled all the data relating to the state in a report just issued by the Survey as Water Supply Paper No. 197. In addition to descriptions of the streams, records of daily gauge heights and estimates of monthly flow, the report includes tabulated elevations of the surfaces of the streams at specified points, by means of which the fall of the streams can be estimated for use as power, and indicates available undeveloped sites. A simple formula for determining the horsepower when fall and flow are known is also presented, and incidental descriptions of the topographic and geological features of the state are given. The paper is ready for distribution, and copies may be obtained without charge by applying to the Director of the U. S. Geological Survey, Washington.

EMPIRE STATE ASSOCIATION.—The annual meeting of the Empire State Gas and Electric Association will be held in the auditorium of the New York Edison Company, 44 West Twenty-Seventh Street, Wednesday, Oct. 2, at 10 a. m. This meeting will be one of unusual interest and importance. At the morning session there will be presented the report of the executive committee and the reports of the various sub-committees which have been appointed during the year. There will also be an account of the publicity work done on behalf of the association. Any business to come before the association will be taken up at this session. In the afternoon several very interesting papers will be presented and discussed. The subjects chosen will be of equal interest to representatives of gas or electric companies. A joint meeting and reception will be held under the auspices of the Street Railway Association of the State of New York and Empire State Gas and Electric Association in the concert hall of Madison Square Garden, New York City, on the evening of Oct. 1, 1907, at 8:30 o'clock. At this meeting addresses will be made as follows: Hon. Frank W. Stevens, chairman, Public Service Commission, Second District, "The Work of the Public Service Commission, Second District, and its Policies with Relation to the Corporations Under its Supervision;" Mr. Henry F. Pierre, president, International Railway Company, Buffalo, N. Y., "The Electric Railway Situation of To-day;" Dr. Alexander C. Humphreys, president, Stevens Institute of Technology, "Control of Gas Companies by State Commissions;" Mr. Everett W. Burdett, chairman of committee on public policy, National Electric Light Association, "Public Control from the Corporate Standpoint." Mr. C. H. B. Chapin is secretary of the Empire State Association. The regular programme of the Association besides special and stated committee reports includes the following papers and discussions: R. M. Searle, "The Meter Testing Situation and Report of Meter Committee;" Alfred E. Forstall, "Gas Standards;" E. L. Elliott, "Buying Light;" L. T. Palmer, "Franchise Taxation;" W. W. Cole, "The Agitation for Underground Distribution in Place of Overhead;" Glenn Marston, "Municipal Ownership in New York State."

STREET CAR BUILDING.—The adoption of electrical energy for traction on street railways has caused a great development of the industry of building cars and their repairs. The value of products for these industries increased generally fourfold between 1890 and 1905, viz., from $6,268,462 to $24,281,317. The number of street railway cars built in 1905 was 4094, valued at $9,902,310. No cable cars were built, and only 42 horse cars. Never was there a more triumphant and complete electric "clean sweep" than that.

N. E. L. A. BULLETIN.—The National Electric Light Association has issued the second number of its bulletin, and is once more to be congratulated upon this addition to its resources and means of usefulness. It contains special articles by Messrs. A. Williams, A. H. Grant and T. C. Martin, and the Question Box data are of unusual interest and value. The need of this means of intercourse among members is already shown by the fact that the first issue has practically gone out of print; and a price has been set for the extra copies that are called for by the member companies.

ELECTRO-GASOLINE CARS.—A special telegram from Appleton, Wis., of Sept. 20, says: "The new Milwaukee Northern Railway proposes to establish a line of electric cars without trolleys. The cars will be operated, if present plans are matured, by electricity generated by gasoline engines in each car. The system is now in use in Germany and has proved successful there. An expert, however, will study the German system before the decision to install similar machinery on the Wisconsin cars is finally taken. The Milwaukee Northern directors figure that a saving of 30 per cent would be effected by this system."

ELECTRIC JEWELS.—In a recent report from the Birmingham district, U. S. Consul Albert Halstead makes the following notes as to Coventry: "The business of hand-made watches is discouraging. The unfavorable conditions of watch making naturally affected the watch-jewel trade, but the jewel makers sought foreign markets. The development of the electrical industry, as that of watch making in the United States, offered a good field for such jewels. In connection with electrical works, sapphire meter jewels are necessary in phonographs. Coventry appears to be the only place in England where electric and watch jewels are manufactured, the sales of this article to the United States in the year 1906 amounting to $89,000.

TICKER TAPE.—When Prince Henry of Prussia drove up Broadway he and his carriage as they passed Wall Street were entangled in Circean folds of streaming ticker tape, just let loose on the breeze. The authorities of Trinity Church have been bothered lately by the tricks of messenger boys and clerks who, from the windows of adjoining skyscrapers, have tossed out coils of ticker tape, which the breezes have promptly festooned about the church and the monuments and trees of its yard. Decorated with the insignia of Mammon, Trinity has looked almost anything but the sedate old pile it really is. Complaints were lodged with the owners of near-by buildings, and now the superintendents have issued circulars to their tenants, who are doing their best to put an end to the desecration of old Trinity.

CENTRAL ELECTRIC RAILWAY ASSOCIATION.—The first regular bi-monthly meeting of the Central Electrical Railway Association, after the summer vacation, will be held at Columbus, Ohio, Sept. 26. The programme, which is now being prepared, will include the report of the standardization committee and two papers will be read, one on the "Single-phase System of Operating Electric Cars," by George D. Nichols, electric engineer of the Indianapolis & Cincinnati traction line, and the other on the "One Thousand Two Hundred Volt System of Operating Electric Trains," by a Westinghouse representative. A good attendance is anticipated, a number of traction men of Michigan, Illinois and Kentucky have been especially invited to attend the meeting.

EXPORT OF ENERGY.—A special despatch from Ottawa, Can., says: "Gen. Greene, of Buffalo, representing the Niagara & Ontario Power Company, has had a conference with Sir Wilfrid Laurier relative to the regulations drafted under the act of Parliament, passed last session, governing the export of electric energy. Before these regulations were finally adopted it was arranged that they should be discussed by the government and representatives of the power company, and a meeting for that purpose was set for to-day. Gen. Greene, however, was the only representative of the company to appear, and discussion of the regulations was postponed until Oct. 1."

TWO-CENT FARES are not popular with the courts, and the decisions against them multiply. The two-cent fare law enacted at the recent session of the Pennsylvania Legislature was adjudged void in its application to the Susquehanna River & Western Railroad Company in an opinion delivered last week at Bloomfield by Judge Shull, of the Perry County Court. The law, he declares, is in derogation of both the United States and the Pennsylvania constitutions. He quoted figures of the company's earnings to show that the enforcement of the rate would be confiscatory, and said that the act is a caprice of a Legislature, "many of whose members, without rhyme or reason, facts or figures, information or reputation, were pledged to perform the act in the name of 'reform.' We might say of reform as was said by Madame Roland of liberty in the days of the French Revolution: 'O Liberty, Liberty! How many crimes are committed in thy name.'"

EUROPEAN LACK OF TROLLEYS.—Mr. Hugh J. McGowan, head of the merger traction lines in Indiana, has returned from a three-month tour of Europe, where he traveled over 5000 miles in an automobile. Mr. McGowan says "that traction facilities in Europe—especially in England—are away behind." There are scarcely any interurban lines, and in the cities there is a poor effort made to carry or accommodate the people. We are away ahead of them when it comes to the traction business. Between Liverpool and London, a little over 100 miles, there isn't an electric line, while the land is as level as a floor. It is surprising that within a radius of 50 miles of Liverpool there is a population of 7,000,000, the most thickly populated country in the world, and not a trolley line in existence for their accommodation. Throughout Great Britain, France, Germany and the most of the other European countries there is a great opportunity for developing the traction business.

COMBINATIONS AND TRUSTS.—A conference will be held in Chicago, Oct. 23-25, under the auspices of the National Civic Federation on combinations and trusts. The attendance will be large, representative and authoritative. The first day will be devoted to the problems involved in the controversies between state and federal government, respecting jurisdiction over interstate commerce. The second day will be devoted to a consideration of the corporation. How should it be constructed? Should there be national corporations as well as state? What should be the basis of capitalization of corporations? their internal control? the provisions looking to the protection of investors and stockholders, as well as fair dealing with the public. Should there be a distinction between public service and other corporations? Should quasi-public utilities, like gas, electric lighting and street railways, be considered natural monopolies to be regulated by the municipality? The third and fourth days will be devoted to a discussion of the just and practicable limit of restriction and regulation, federal and state, of combinations in transportation, production, distribution and labor.

SPEED CONTROL OF AUTOMOBILES.—An effort is being made in England to compel the use on automobiles of automatic speed controllers to prevent a machine from running above a maximum speed on public roads.

NO CIVILITIES OVER TELEPHONE.—It is stated that the Keystone Telephone Company, of Philadelphia, has decreed that the word "please" shall not be used in colloquies over its lines on the ground that the word is unnecessary and that its use consumes an aggregate of 125 hours daily.

CHICAGO EXPOSITION.—At a recent meeting of the stockholders of the Electrical Trades Exposition Company, of Chicago, Mr. Homer Niesz was again elected manager of the show. Mr. Samuel Insull is president, with Mr. E. B. Overshiner, chairman of the executive committee. The major portion of the space has already been applied for and a larger and better show than ever before is assured for next January in the Coliseum.

ATLANTA TELEPHONE FRANCHISE.—A despatch from Atlanta, Ga., states that the City Council has granted to the Southern Bell Telephone & Telegraph Company a renewal of its franchise, and it has been accepted by the company. The company's right to do business in Atlanta is extended for 33 years, subject to a tax of 1 per cent on gross receipts. From this tax is to be deducted the amount of ad valorem taxes paid by the corporation on its tangible property.

STANDARD SYMBOLS FOR WIRING PLANS.—The National Electrical Contractors' Association has printed in definitive form the schedule of standard symbols for wiring plans as adopted and recommended by the Association and the American Institute of Architects. The chart may be obtained from Mr. W. H. Morton, Utica, N. Y., secretary of the association, upon payment of 10 cents for the wall-hanger form, or $1 per hundred in the form of specification sheets.

MOTOR CABS FOR CALCUTTA.—Consul-Ggeneral W. H. Michael, at Calcutta, reports that a London company, with a capital of £100,000, has offered to provide Calcutta with electric motor-cab service commencing in October next, providing the authorities will encourage the enterprise and afford facilities. The chairman of the corporation and commissioner of police have given the promoters assurance of welcome and protection. The cabs will be capable of covering 100 miles per day.

ITALIAN EDISON COMPANY.—A special despatch from London states that the Edison Power Company has arranged for an extensive supply of high-tension energy in Italy. Contracts have been made with the municipalities of Rome, Genoa, Naples and Milan. The installation will be begun at Milan this week. The Edison Company will first operate the tramways in Milan under an arrangement whereby the municipality will lay and own the tracks, the Edison Company owning the cars and paying the city mileage for each car.

STRANGE TELEPHONE STRIKE.—Advices from Helena, Mont., of Sept. 22, say that because the business men of Helena refused to discontinue the use of telephones pending a settlement of the Rocky Mountain Bell Telephone Company's strike the Helena Trades & Labor Assembly has decided to call a general strike in Helena this week. The result of this action, it is said, will be a complete tie-up of street-car service and the closing of hotels, manufacturing establishments, business houses, and even saloons where the use of telephones has not been discontinued.

STRAP HANGERS' RIGHTS.—The conductors of the New York Fifth Avenue electric omnibuses have much difficulty in enforcing a rule prohibiting passengers being taken on beyond the seating capacity of the vehicles. In some instances the refusal has been resented as a denial of a cherished right to occupy standing room if one chooses. In England it seems that public service companies have also difficulty in enforcing a similar rule. Recently a passenger on a London electric railway car was haled before a magistrate and fined one shilling and costs for the offence of standing in a car.

TELEPHONY IN AUSTRALIA.—U. S. Consul-General John P. Bray reports that the two leading cities of Australia, Melbourne and Sydney, are now connected by telephone. The line is a little over 600 miles in length and is composed of two exceptionally strong and heavy copper wires; the cost of construction was $227,198 and it took four months to complete. The fee for conversations, viz., 6 shillings ($1.46) for three minutes is thought to be too high in business circles, but the postmaster-general, by whose department the line is controlled, has stated that if after three months' trial the line proves payable a series of progressive reductions in the rate will be made.

CHINESE WIRELESS.—U. S. Consul W. T. Gracey makes the following report regarding the German Government's new wireless telegraph station at Tsingtau, China: The local wireless station is on top of the Diederichs Hill, 328 ft. high, next to the signal station. For ships coming from the direction of Tschalien-tau light this hill appears as the farthest hill toward the south, and stands clear of the Bismarck, Iltis, and Prince Henry mountains, lying farther north. The square towered building of the signal station, as well as the near-by mast of the wireless apparatus, are easily recognized a long distance out at sea. The system in use is "Telefunken," of Slaby-Arco, with a mast, the distance of activity being about 100 nautical miles. The station is the property of the Kiaochow Government, and is used to communicate with men-of-war of the German navy, but will be thrown open for general public use before long on conditions which have not as yet been determined.

RINGEDALSVAND POWER.—U. S. Consul F. S. S. Johnson, of Bergen, reports that a tunnel is being constructed which will bring the water from the great Ringedalsvand of Norway (into which the Skjaeggedalsfos falls) down to the fiord, which is a very remarkable piece of work, a brief description of which is presented: First, from that lake there is a tunnel 300 meters long to another small one, known as the Lillevand. From this point there is a tunnel 4,600 meters in length, 3 meters wide and 2½ meters high, to the face of the rock facing the Sorfjord. From this tunnel the water will be conveyed in strong pipes down the 400 meters decline to the fiord. Down at the sea level and close to the wall of rock is the power station, from which the electrical energy will be conducted along the seven-kilometer (4.3-mile) stretch to the factory at Odda. The capacity available is estimated at 40,000 hp, of which 20,000 hp will be at once utilized when the factories are working.

PACIFIC CABLE BREAK.—It is announced by the officers of the Commercial Cable Company that there had been a break in their Pacific cable somewhere between the relay stations at Midway Island and Guam. They are inclined to think that an earthquake may have been responsible for the interruption in the cable service, but in the absence of all word from the operators at Guam they could not assign a cause positively. The cable that goes under the Pacific from San Francisco to Yokohama and the Philippines via Honolulu, Midway and Guam went dead on Friday, Sept. 20. Midway, which lies between Honolulu and Guam, reported that the spark went out of the submarine wires without warning and that all efforts to communicate with Guam had been unavailing so far this week. Since the Commercial Cable Company line is the only one connecting America with the Orient directly, all cables for the Philippines, Japan and points on the China coast will have to be sent around the other way at a rate about double that charged across the direct San Francisco-Yokohama line.

The Tofwehult-Westerwik Transmission System, Sweden.

BY ARVID WESTERBERG.

AN electrical equipment recently installed in Sweden for transmitting energy from Tofwehult to Westerwik possesses some interesting details, which are outlined below. The plant consists of a power house at Tofwehult, a transmission line thence to the town of Westerwik, and transformer and converter stations in that town.

THE POWER HOUSE.

The natural surroundings of the waterfall at Tofwehult rendered it especially favorable for development, because it is situated between two lakes, and the connection between these, which forms the fall, consists of a deep cleft with almost vertical sides. (See Figs. 1, 2 and 3.) In consequence the hydraulic work was very simple and cheap; the costs of the hydraulic work and the power house building amounted to only $26,000, which, on the basis of the maximum output of 1300 horse-power, including the reserve, is only $20 per horse-power. The power house is built for three generating sets, two for 325 horse-power each, and one for 650 horse-power; only the two smaller sets are now installed.

The turbines showed under test an efficiency at full load of 81 per cent, and a speed variation of only 6 per cent at a load variation from full load to no load. An interior view of the power house is shown in Fig. 4. Each of the generators is built for 10,000 volts and 285 k. v. a. The major insulation of the armature coils consists of several layers of oiled cloth and a final coating of an insulating compound. At the insulation test of one of these coils, the breakdown occurred at 45,000 volts.

A separate extension of the power house is provided for the switch gear. As seen in Fig. 4, the lightning arresters are placed on the upper floor of this extension. The lower floor, which is separated from the generator hall by the switchboard, contains all other apparatus and instruments for low and high tension. The high-tension equipment is placed in a compartment separated by iron grating and accessible from both sides.

FIG. 4.—VIEW OF INTERIOR OF POWER HOUSE.

In order to prevent the accumulation of static electricity on the high-tension line a static protector is provided. This apparatus consists of six vertical glass pipes, two for each phase (Fig. 5), through which water flows continuously. The upper connection between the two pipes of each phase consists of an iron faucet which is connected to the corresponding bus-bar.

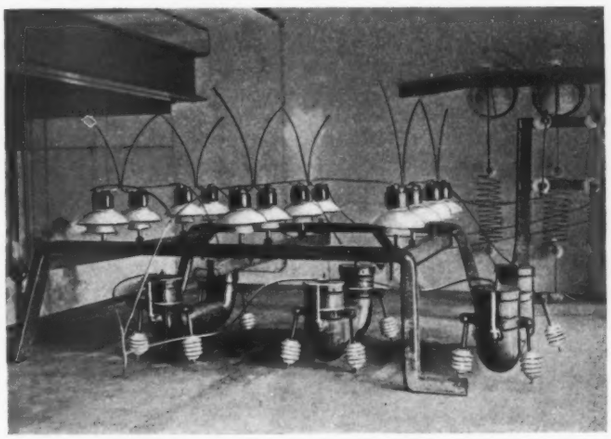


FIG. 5.—LIGHTNING ARRESTER EQUIPMENT.

The iron pipes, through which the water is carried to and from the apparatus and which are connected to the lower ends of the glass pipes, are grounded. The water being very pure and therefore its specific resistance being high, the current leaking through the apparatus is small, amounting to only 0.036 amp. per lead; this value is probably rather too small to secure a good efficiency of the device.

FIGS. 1, 2 AND 3.—FALLS BEFORE AND AFTER BEING HARNESSED; POWER HOUSE FROM BELOW AND ABOVE.

THE HIGH-TENSION LINE.

About half way between Tofwehult and Westerwik a deep bay of the Baltic cuts into the land. If the transmission line had been erected around this bay the length would have been increased by 3.75 miles above the straight distance of about 9 miles between the power house and the town. The increase could be avoided by crossing the bay by means of either a submarine cable or a long overhead span. In order to obtain sufficient security against breakdowns of a cable in the middle of an overhead line of 10,000 volts it would have been necessary to install special protection devices, and to erect two cables. Even if these provisions had been made the crossing by cable would not only entail a lower degree of working security, but would also cause higher running costs. Since, not far from the straight line between the power house and the town, the bay forms a narrow strait with steep shores, it was decided to build at this point an overhead span of sufficient height to avoid all sails. A view of this span is given in Fig. 6. The length of the span is 735 ft., and the height over the water is, at the lowest point, 131 ft. The conductors consist of steel-wire ropes, each 60 sq. mm. in cross section; they are supported by iron masts, each having a height of 82 ft., two on each side, which carry insulating supports.

A view of an insulating support is given in Fig. 8. It consists of an oak block, resting on six high-tension insulators. The insulators are cemented to the oak block, their iron pins being fastened to the brackets of the mast. The oak block is

protected against moisture by a coating of sheet zinc. In order to prevent the pull of the wire ropes from acting on the masts, a rolling device is provided. The rolling device consists of a cast-iron plate resting on the oak block, four cast-iron rolls and a cast-iron piece which rests on these rolls and to which the wire ropes are fastened by screws. The terminals of the wire ropes are anchored to the rock. Thus they act as a guy to the casting to which the wire rope is fastened, and prevent it from rolling out of the cast-iron plate. Slipping to the side is prevented by flanges on the rolls. Four wire ropes are mounted in this way, one of which serves as reserve. As stated above, the cross-section of each rope is 60 sq. mm. Each wire rope has, therefore, the same conductivity as a copper wire about 7 sq. mm. in cross-section. At 30 deg. C. the strain in the span part of the rope is 1300 lbs., and in the guy part 1650 lbs. Thus the maximum stress equals 17,800 lbs. per sq. in., corresponding to a safety factor of 5. The sag of the rope at 30 deg. C. equals 29.5 ft. In spite of this sag a contact between the ropes is impossible since they are mounted at different heights and the horizontal distance of about 6.5 ft. is ample. Moreover, it has been proved that even in a strong wind the wires do not swing; all of the ropes are deviated to the same constant angle from the vertical plane whereby the distance between the ropes is not changed.

As mentioned above, the wire ropes are anchored to the rock. Therefore, it is necessary to put special strain insulators into the guy part of the ropes. The strain insulator which is shown in Fig. 9, must withstand a mechanical force of 1650 pounds and at the same time secure a good insulation. The insulators are coupled in series by twos; therefore, at the regular working conditions each insulator is subjected to a voltage of 3000. Still, in order to get a high degree of security, each insulator was designed for 20,000 volts. The insulator is covered on the top and sides by a cap of sheet zinc whereby it is perfectly protected against moisture. The dry insulator in actual tests withstood a tension of 25,000 volts. As to the mechanical strength a lining of sheet lead between the iron and the porcelain effects an equal distribution of the mechanical pressure upon the latter and since porcelain possesses a great strength against pressure it was not difficult to make the span insulators sufficiently strong mechanically.

A telephone circuit is erected on the high-tension line poles. For this line common telephone insulators are used; the telephone lines are so transposed that one whole turn is made at every fifth pole. The high-tension line is transposed one turn at every 1000 ft. In telephoning over this line a humming sound is heard. The noise is not so loud as to disturb the conversation. It is probably partially caused by the grounding of the neutral point at both the transformer station and (through the static protectors) in the power house.

TRANSFORMER AND CONVERTER STATIONS AND DISTRIBUTING CABLES.

In the main transformer station at Westerwik the e. m. f. is transformed to 500 volts, three-phase, and 3000 volts, three-phase. The former voltage is used for distribution within an industrial district in the neighborhood of the transformer station; the latter is used for transmission to the converter station which is built close to the old city plant. The converter station is arranged for four motor-generator sets; two of these are installed at present. The direct e. m. f. is 2 x 110 volts, but everything is so planned that later on an e. m. f. of 2 x 220 volts can be adopted without any difficulty. The station reserve equipment includes a storage battery, while the steam-driven direct-current generators of the old city plant also constitute a valuable reserve. Transformer station No. 2 supplies energy to some factories in its neighborhood by means of three-phase current at 500 volts.

The distribution of the direct current used in private lighting, for small motors and for the street lamps within the city is accomplished by means of earth cables. The street lighting is furnished by 65 enclosed 7-amp. arc lamps. Two of these lamps are connected in series across the 220-volt supply mains.

FIGS. 6 AND 7.—VIEWS OF STEEL MAST USED ON LONG SPAN.

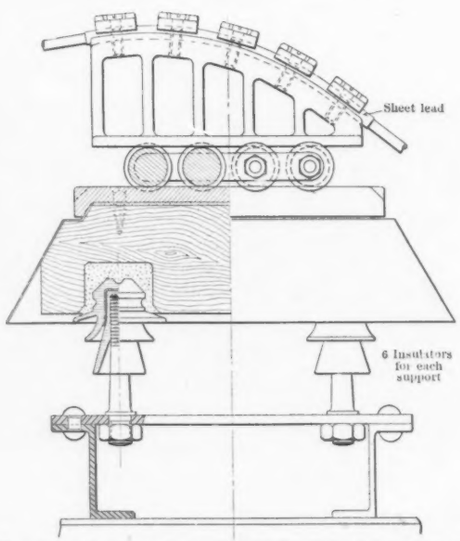


FIG. 8.—INSULATING AND ROLLING SUPPORT FOR LONG SPAN.

The costs given below refer to the two generator sets installed at the present time. The total cost of the fully installed power house and equipment for 1300 horse-power would be about $46,000. Referred to the entire equipment including the

reserve, namely 880 kw, the cost was $52.70 per kw at the power house and $65.40 at the end of the high tension line; the corresponding costs per horse-power are $39 and $48, respectively.

The following list of costs of various items may prove of interest:

COST OF EQUIPMENT.

Dam and power house	$26,200.00
Two 325-hp turbines and two 45-hp turbines	4,800.00
Two 285-kw and two 30-kw generators	5,200.00
Station wiring and instruments	1,900.00
	$38,100.00
Nine miles (27 total) of circuit 19.6 sq. mm., including poles and right of way	$11,000.00
	$49,100.00

This plant was laid out by the engineering firm, David Bergman, of Stockholm. The cables and the arc lamps and the

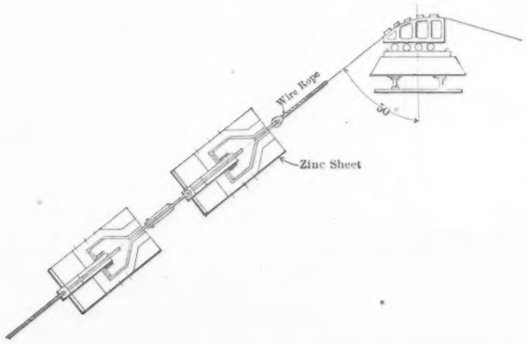


FIG. 9.—STRAIN INSULATORS FOR LONG SPAN.

rest of the electric parts of the plant were furnished by the Elektriska Aktiebolaget, Stockholm.

Magnetic Hysteresis Phenomena.

BY M. O. BOLSER.

What hysteresis exactly is is often lost sight of and though often of no practical importance, occasionally cases may arise in which it is important.

In direct-current circuits the conditions can be represented by $I = \frac{E}{R}$, and similarly in magnetic circuits $\phi = \frac{(m.\,m.\,f.)}{\mathfrak{R}}$ where ϕ is the flux and $\mathfrak{R}$ the reluctance, or magnetic resistance. In alternating-current circuits, likewise, $I = \frac{E}{Z}$, in in which I can be ahead of or behind the e. m. f. E, in time-phase. Similarly in alternating magnetic circuits, the equivalent sine wave of flux ϕ can lag behind or lead the equivalent sine wave of m. m. f. The phenomenon connected with this time-phase displacement between the m. m. f. and the flux is known as hysteresis, and the angle of time-phase displacement is called the hysteretic angle of advance.

In Weber's molecular magnetic theory of magnetism, he considers each and every molecule of a magnetic material as a magnet. An unmagnetized piece shows no aggregate polarity merely because the axes of the molecules point in all directions at random. When a magetizing force is applied, the molecules turn into line and show an aggregate polarity. The completeness and degree to which the molecules turn depends upon the structure of the magnetic material and upon the magnetizing force. In a piece of magnetic material there must be magnetic ties between the different molecules. Whenever the magntizing force is sufficiently great to involve the breaking up of old ties and the forming of new ones, there is an unstable phase movement of some of the molecules. This tendency to hold to old magnetic ties is called "molecular magnetic friction." The energy imparted to the molecules in giving them kinetic energy is dissipated again as eddy currents in the neighboring molecules. In the ordinary case, hysteresis loss is a measure of this molecular magnetic friction loss. Fig. 1 shows this condition

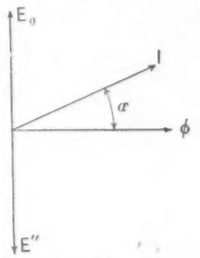


FIG. 1.—CONDITION OF CIRCUIT WITH NEGLIGIBLE RESISTANCE.

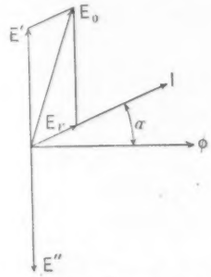


FIG. 2.—RESISTANCE AND REACTANCE DUE TO HYSTERESIS.

in a circuit of negligible resistance. E_0 is the e. m. f. impressed upon a coil containing an iron core. I is the current, ϕ the flux lagging behing I by the angle α, the hysteretic angle. E'' is the counter e. m. f. of self-induction. In this case $E_0 I \sin \alpha$ is a measure of the molecular magnetic friction loss and α is a measure of the "hysteresis."

At this point, it might be well to consider the effective resistance and effective reactance attributable to hysteresis. In Fig. 2, E_r is the e. m. f. to overcome the ohmic resistance drop, E_0 is the impressed e. m. f., E' the e. m. f. necessary to overcome, E'' the counter e. m. f. of self-induction.

If E_0 be divided up into power and wattless component, the effective resistance and effective reactance may be obtained. This is shown in Fig. 3. E'_r is the e. m. f. to overcome the

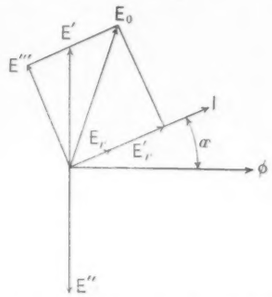


FIG. 3.—POWER AND WATTLESS COMPONENTS.

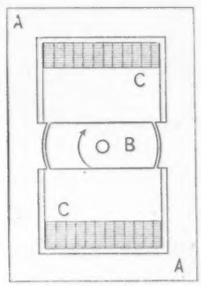


FIG. 4.—EICKEMEYER ENERGY-LOSS LOOP DEVICE.

effective resistance drop and is larger than E_r the e. m. f. to overcome the ohmic resistance drop.

E''' is the e. m. f. of the effective reactance drop, which is smaller than E' the counter e. m. f. of self-induction.

Thus, in a circuit of the above character, hysteresis makes the effective resistance higher and the effective reactance less than ohmic resistance and the magnetic reactance.

While the energy loss in molecular magnetic friction is essentially a constant quantity per cycle, but the apparent hysteresis loss as measured in the primary magnetizing circuit can be zero, positive or negative, and this apparent loss can be greater or less than the molecular magnetic friction, and therefore such apparent loss is not a measure of the true hysteresis loss under some conditions. In a circuit where the only expenditure of power is in the iron, the loss observed in the magnetizing circuit is a measure of the molecular magnetic friction. However, as soon as there is some other source of power present, or power can be consumed in some other way, this coincidence disappears and the "apparent" hysteresis loss has no direct relation to the true molecular magnetic friction.

For instance, consider an electric circuit interchanging energy cyclically with a laminated iron magnetic circuit in which some of the laminations are loose and free to vibrate. The "apparent" loss now not only supplies the power for molecular magnetic friction, but also that required to vibrate the loose laminations. The area of the so-called "hysteresis loop"

in this case gives not only the energy dissipated during each cycle in molecular magnetic friction, but also that in vibrating the laminations. Under proper conditions, with energy supplied from some source outside the electric circuit, the "hysteresis" loop may not only disappear, but it can overturn and become negative, thereby showing that more energy is taken into the electric circuit during each cycle than is restored to the auxiliary source.

The above-described phenomena were demonstrated by Mr. Eickemeyer, who made use of the device shown in Fig. 4. In this illustration *AA* are the laminated stampings of a shell-type "transformer;" *CC* is the winding; *B* is the center core, which is mounted in such a way that it can be rotated. If an alternating current be supplied to the winding *CC*, an alternating flux is set up in the center core, *B*. When this center core, *B*, is rotated at such a speed that it reverses direction just as the magnetizing force reverses, the speed is said to be "synchronous." When once brought up to synchronism, this apparatus will work as a synchronous motor and will give many peculiar energy-loss loops. When the friction and molecular magnetic friction are just supplied by some external driving power, the "loop" disappears, which merely means that its area reduces to zero. However, when this device is loaded as a motor, the energy-loss loop opens up to such an extent that during each cycle it takes energy enough from the electric circuit not only to supply molecular magnetic friction, but also to supply the

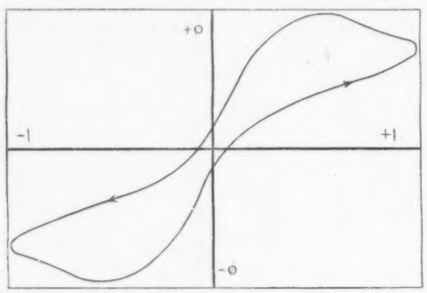


FIG. 5.—ENERGY-LOSS LOOP.

mechanical energy put out. Fig. 5 shows an energy-loss loop of this character.

If the auxiliary source supplies more energy per cycle than is necessary to overcome the friction and molecular magnetic friction the energy-loss loop overturns and the flux now leads, in place of lagging behind the magnetizing force in time-phase. Consequently, the energy-loss loop shows that energy is put into the electric circuit, and the machine might be called a "hysteresis" generator.

Fig. 6 shows an energy-loss loop under these conditions. Though a small part of this loop shows energy taken from the

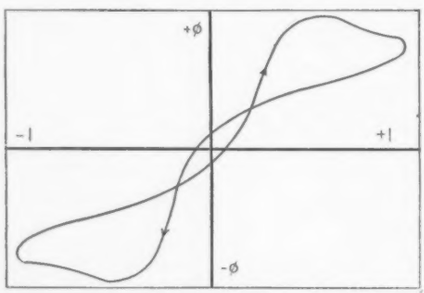


FIG. 6.—ENERGY-LOSS LOOP.

electric circuit, by far the larger part of the loop represents energy given into the electric circuit.

It will be seen from the above that molecular magnetic friction is constant per cycle of a magnetic circuit, but that the "apparent" hysteresis can have many values, depending upon the surrounding conditions.

The question now arises as to the method by which the energy is transferred from the primary to the secondary circuit of a transformer. A little consideration will show that the energy does not appear in the "hysteresis" loop. The m. m. f. which propels the flux through the core is not the m. m. f. that supplies energy for the secondary circuit and for the eddy currents. In other words, the primary m. m. f. can be split into two components, one of which balances the counter m. m. f.'s and the other of which propells the flux through the magnetic circuit. The area of the "hysteresis" loop represents the exchange of energy between the electric circuit and the magnetic circuit due to the pulsations of reluctance being unsymmetrically situated with respect to the alternations of the flux. This unsymmetrical situation can be caused either by molecular magnetic friction or by synchronous motion. In the first case, the maximum value of the flux always occurs at the same time as the maximum value of the distorted wave of m. m. f. However, in the second case this condition does not necessarily exist.

Tension and Sag in Wire Spans.

By Harold Pender, Ph.D.

THE accompanying charts* (No. 1 for long spans, No. 2 for short spans) enable one to determine without arithmetical computation the variation of the tension and sag in copper wire spans with the temperature and resultant load on the wire. Similar charts can be readily prepared for wires of any material.

The symbols used in the discussion below are as follows:

m = weight of wire per cubic inch in pounds.
α = coefficient of linear expansion of wire per degree Fahr.
M = modulus of elasticity of wire (pounds—square inch)
ρ = ratio of resultant of the weight of wire, the weight of sleet and the wind pressure to the weight of wire.
l = length of span in feet
t = rise in temperature in degrees Fahr.
T = tension in thousands of pounds per square inch
D = deflection at center of span in feet in direction of resultant force when points of suspension are on the same level.
S = vertical sag at center of span in feet when points of support are on the same level.

The lines on the charts are plotted as follows:

The hyperbolic curves on the right have the equation $y = \left(\frac{\rho}{T}\right)^3$ where y is the ordinate and T the abscissa. A curve is plotted for $\rho = 1.0, 1.2, 1.4 \text{----} 4.0$, The value of ρ for each curve is indicated at the top of the chart. It is to be noted that the horizontal distance between these curves at any level is directly proportional to the increment in the value of ρ. These curves are independent of the material of the wire.

The inclined straight lines have the equation $y = \frac{10^9}{6\,M\,m^2\,l^2}\,T$.

For a given material the equation of these lines depends only on the length of the span. The lines on the charts are drawn for copper wire for which $m = 0.321$ and $M = 12 \times 10^6$. The corresponding length of span is indicated on the right-hand margin of the charts. For any other material, the line for a given length of span will have a different slope.

The temperature scale on the X axis to the right of the origin is laid off so that $x = Mat$. The scale given on the chart is for copper for which $M = 12 \times 10^6$ and $\alpha = 9.6 \times 10^{-6}$. This scale will be different for any other material.

The parabolic curves on the left of the chart have the equation $D = 0.0015\, m\, l^2 \sqrt{y}$, where D is measured off from the left of the origin. For a given material these curves are fixed by the length of the span. The curves given on the chart are for copper, for which $m = 0.321$. The corresponding lengths of span

*These charts were devised to obtain a graphical solution of the equations deduced by the author in an article in the Electrical World for Jan. 12, 1907, Vol. 49, p. 99.

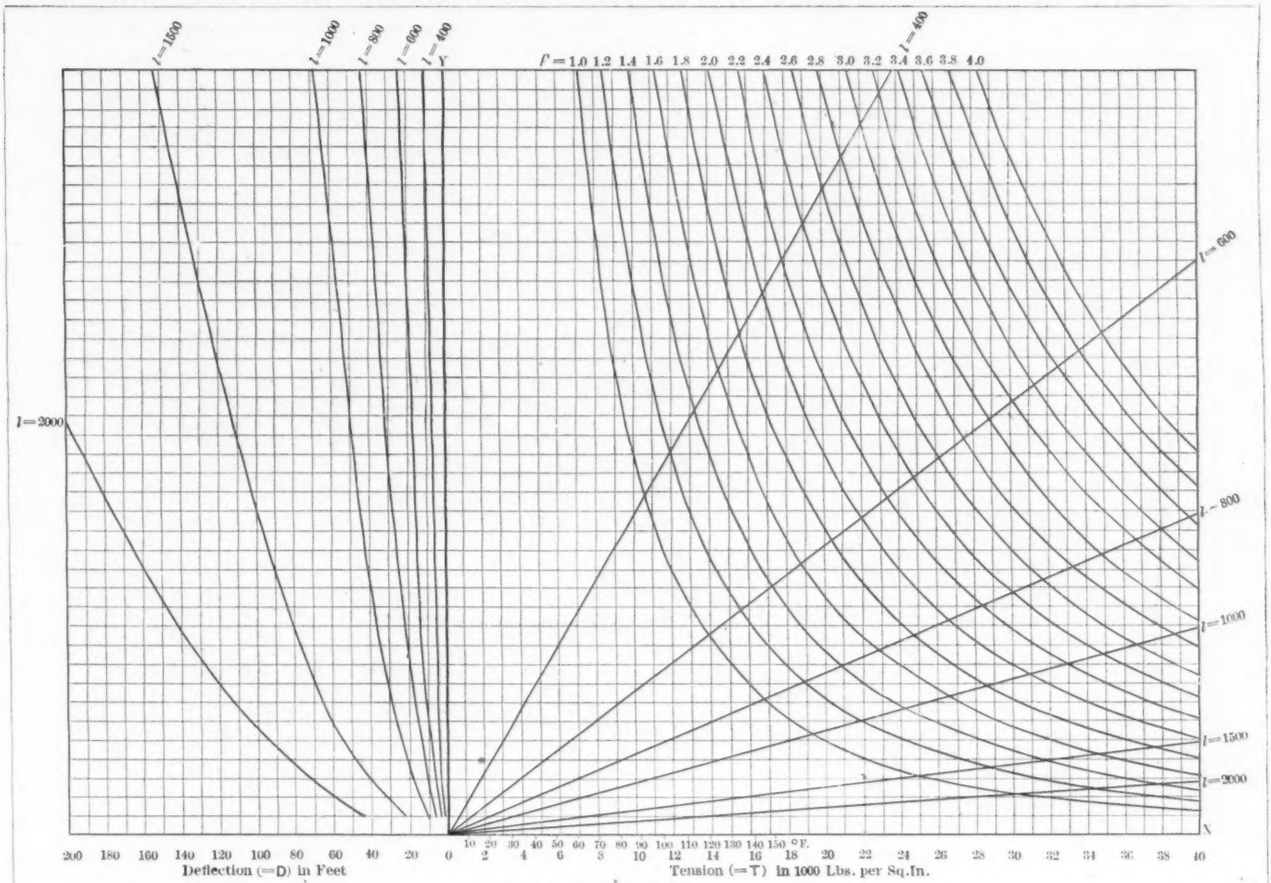


FIG. 1.—CHART FOR LONG SPANS.

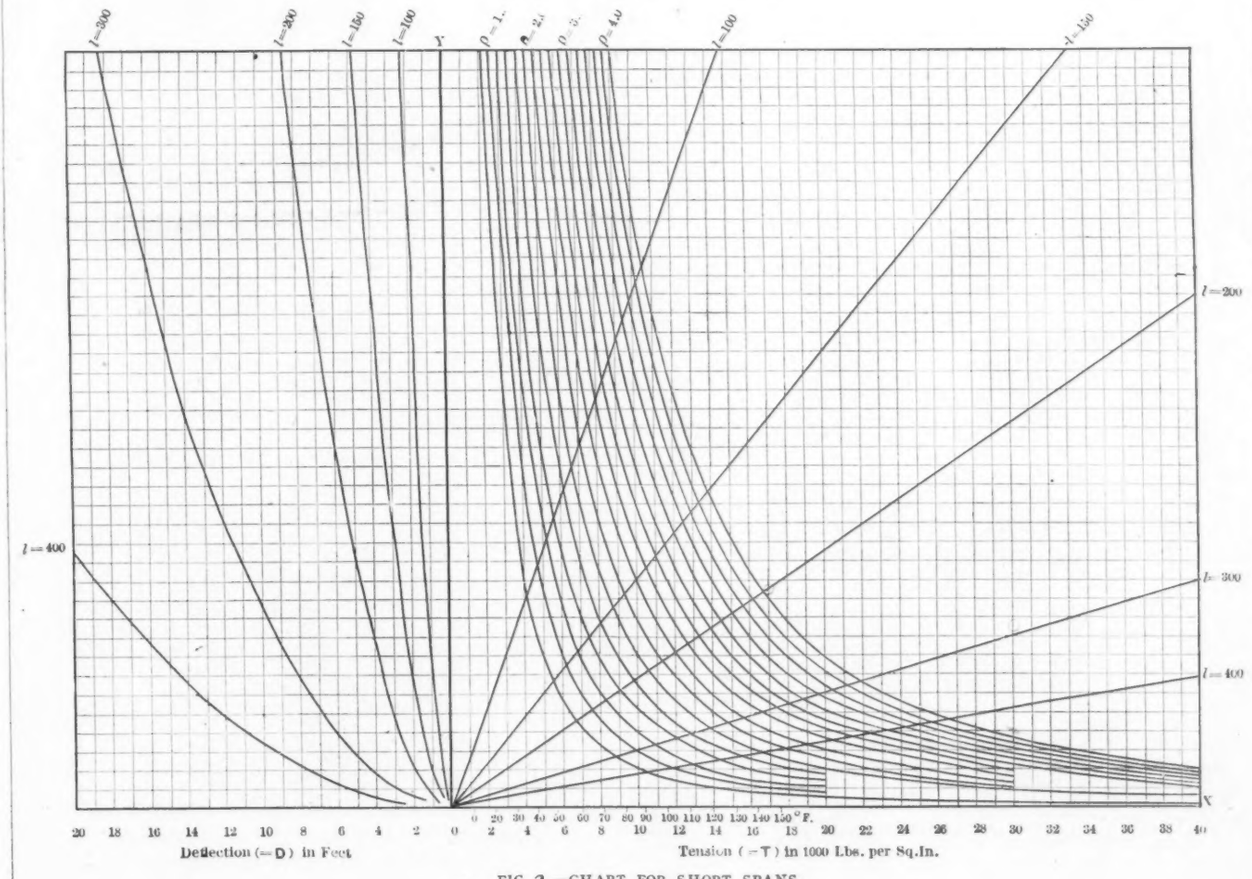


FIG 2.—CHART FOR SHORT SPANS.

TENSION AND SAG IN WIRE SPANS.

are indicated on the curves. These curves will be different for any other material.

Rules for the Use of the Charts.

Given: A span of length l and the points of support on the same level; tension T_1; ratio of resultant force to weight of wire, ρ_1; to find the tension T when the temperature rises t degrees and the ratio of resultant force to weight of wire changes to ρ (for example, sleet melts off).

At the point 1 (Fig. 1) on the curve corresponding to ρ_1 and having the abscissa T_1 lay off 12 = the ordinate of the point 3 on the line corresponding to l having the abscissa t on the temperature scale.

Through 2 draw a line parallel to the line l: the abscissa of the point 4 where this line cuts the curve corresponding to ρ is the tension T at the temperature t when the ratio of resultant force to weight of wire is ρ. The abscissa of the point 5 where the horizontal line through 4 cuts the parabolic curve corresponding to l gives the corresponding deflection D at the center of the span in feet. Instead of actually drawing the straight line 24 a pair of compasses may be used; *i. e.*, lay off the distance 12, then open the compasses until the lower point touches the straight line l; then keeping the compasses vertical, slide the lower point along l until the upper point intersects the curve corresponding to ρ. If t is negative, *i. e.*, if the temperature decreases, lay off 12 in the opposite direction. To determine D with greater accuracy use the formula

$$D = .0015\, m\, l^2 \frac{\rho}{T}$$

Calculation of ρ.

Let w = weight of wire in pounds per foot.

The weight of sleet (and hemp core, if any) in pounds per foot of wire is

$$w_1 = 0.314\ (d_1^2 - d^2) + 0.25\, d_0^2$$

where d is the diameter of the wire, and d_1 the diameter over sleet and d_0 the diameter of the core, all in inches.

The wind pressure in pounds per foot of wire is*

$$w_2 = 0.00021\, V^2 d_1$$

where V is the actual wind velocity in miles per hour; $d_1 = d$ in case of no sleet. The relation between indicated wind velocity (as given by U. S. Weather Reports) and actual velocity is as follows:

Indicated Velocity.	Actual Velocity.
10	9.6
20	17.8
30	25.7
40	33.3
50	40.8
60	48.0
70	55.2
80	62.2
90	69.2
100	76.2

The ratio of ρ is then

$$\rho = \sqrt{\left(1 + \frac{\omega_1}{\omega}\right) + \left(\frac{\omega_2}{\omega_1}\right)^2}$$

Calculation of Vertical Sag.

In case of no wind the vertical sag S is the same as the deflection D. The wind pressure gives a horizontal component to the resultant force so that the vertical sag when wind is blowing is

$$S = \frac{D}{\sqrt{1 + \left(\frac{\omega_2}{\omega + \omega_1}\right)^2}}$$

Example: A No. 00 stranded copper cable is to be strung in still air at 70 degs. Fahrenheit between two points on the same level 800 ft. apart, so that at a temperature of zero degrees Fahrenheit, with a coating of sleet ½ in. thick all around and wind blowing perpendicularly to the cable at 65 miles an hour (actual velocity) the tension in the cable will be 30,000 lbs. per square inch; (1) at what tension must the cable be strung and (2) what will be the vertical sag at stringing temperature, *i. e.*, 70 degs., also (3) what will be the sag at zero temperature when the cable is coated with ½-in. of sleet and wind is blowing with a velocity of 65 miles an hour, and (4) what will be the sag at a temperature of 150 degs. in the still air?

We have

$$\omega = 0.406$$

$$\omega_1 = 0.314\ (1.418^2 - 0.418^2) = 0.425$$

$$\omega_2 = 0.0021 \times 65 \times 1.418^2 = 1.26$$

Therefore, at zero degrees with wind and sleet

$$\rho_0 = \sqrt{\left(1 + \frac{0.425}{0.406}\right)^2 + \left(\frac{1.26}{0.406}\right)^2} = 3.72$$

(1) Measure off with compasses on chart No. 1 the vertical distance from $t = 70$ on X axis to the straight line corresponding to $l = 800$. Lay this distance off vertically above the point on the curve corresponding to $\rho = 3.72$ having the abscissa $T = 30$. Keep the upper point fixed, open the compasses until the lower point touches the line $l = 800$; then, keeping the compasses vertical, slide the lower point along the line $l = 800$ until the upper point intersects the curve $\rho = 1$ at $T = 8.95$; the cable must therefore be strung at a tension of 8950 pounds per square inch. (2) The abscissa of the point on the parabolic curve $l = 800$, having the same ordinate as the point

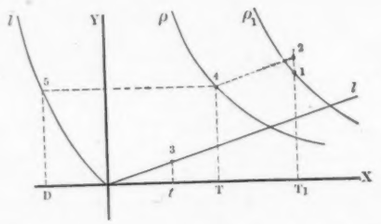


FIG. 3.—METHOD OF COMPUTING FROM CHARTS.

corresponding to $\rho = 1$ and $T = 8.95$ is $D = 34.4$ feet, which is the vertical sag S, in still air at 70 deg. F.

(3) The deflection at zero degrees with sleet and wind is the abscissa of the point on the parabolic curve $l = 800$ having the same ordinate as the point corresponding to $\rho_0 = 3.72$ and $T_0 = 30$, *i. e.*, $D_0 = 38.2$ feet.

The vertical sag is

$$S = \frac{38.2}{\sqrt{1 + \left(\frac{1.26}{.831}\right)^2}} = 21.0 \text{ feet.}$$

(4) To find the sag at 150 deg. proceed as under (1) and (2) taking $t = 150$. The sag will be found to be $S = 36.8$ feet.

Wire Suspended from Points Not on the Same Level.

The charts also apply directly to the determination of the change in tension in spans when the points of support are at different heights. In this case, however, the vertical sag S_1 (= deflection in case of no wind) below the highest point of support is given by the formula

$$S_1 = S\left(1 + \frac{h}{4S}\right)^2$$

where h is the difference in height of the two points of support and S is the vertical sag for a span of *equal* length but points of support on the *same* level; S is calculated by the formula given above, *i. e.*

*H. W. Buck in Transactions International Electrical Congress, 1904.

$$S = \frac{D}{\sqrt{1 + \left(\frac{w_2}{w + w_1}\right)^2}}$$

D being the deflection, taken directly from the chart, for a span of *equal* length but points of support on the *same* level; in case of no wind $S = D$. The distance of the point of maximum sag from the highest point of support is

$$\frac{l}{2}\left(1 + \frac{h}{4S}\right)$$

When h is greater than $4S$ the lowest point of support is the point of maximum sag, *i. e.*, the lowest point in the span.

Example: In the example given above suppose the difference in height of the points of support is 20 feet. Then (1) the tension at 70 deg. will still be 8950 lbs. per sq. in. (2) The corresponding vertical sag at 70 deg. in still air for points of support at same level is 34.4 feet, therefore, for the span under consideration the vertical sag from the highest point of support is

$$34.4\left(1 + \frac{20}{4 \times 34.4}\right)^2 = 45.1 \text{ feet.}$$

(3) The vertical sag at zero degrees with sleet and wind for points of support on the same level is 21 feet; therefore, for a 20-ft. difference in the height of points of support, the vertical sag from the highest point of support is

$$21\left(1 + \frac{20}{4 \times 21}\right)^2 = 32.1 \text{ feet.}$$

(4) The vertical sag at a temperature of 150 deg., for points of support on the same level is 36.8 feet; therefore, for a 20-foot difference in height of the points of support the vertical sag from the highest point of support is

$$36.8\left(1 + \frac{20}{4 \times 36.8}\right)^2 = 47.5 \text{ feet.}$$

The accompanying table, giving the value of T and ρ for various values of $y = \left(\frac{\rho}{T}\right)^2$ will be found useful in plotting the hyperbolic curves in case one wishes to make charts on a larger scale than those given herein, or similar charts for wires having different constants. The other lines are readily plotted from the equations given above.

Table Giving the Value of T for Various Values of ρ and $y = \left(\frac{\rho}{T}\right)^2$

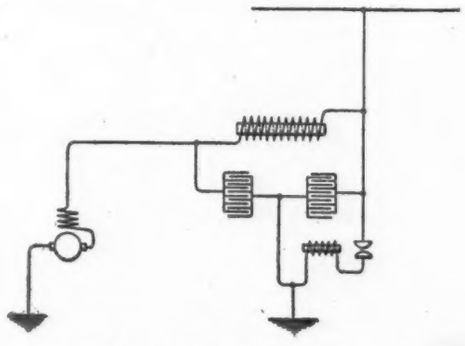
Values of $y = \left(\frac{\rho}{T}\right)^2$	Values of ρ															
	1.0	1.2	1.4	1.6	1 8	2.0	2.2	2.4	2.6	2.8	3.0	3.2	3.4	3.6	3.8	4.0
.2	2.24	2 68	3 13	3 58	4.02	4 47	4.92	5.37	5.81	6 26	6.71	7 16	7.60	8.05	8.50	8.94
.17	2.43	2.91	3.40	3.88	4.37	4 85	5 34	5 82	6 31	6 79	7.28	7 76	8.25	8.73	9.22	9.70
.13	2 77	3 33	3 88	4.44	4.99	5 55	6.10	6.66	7 21	7.77	8.32	8 87	9.43	9.98	10.54	11.09
.10	3.16	3 79	4.43	5 06	5.69	6.32	6 96	7.59	8 22	8 85	9 49	10 12	10.75	11.38	12.02	12.65
.07	3.78	4 54	5 29	6.05	6 80	7 56	8.32	9.07	9.83	10 58	11.34	12.10	12.85	13.61	14.36	15.12
.04	5.00	6.00	7.00	8.00	9 00	10.00	11.00	12.00	13 00	14 00	15.00	16 00	17.00	18.00	19.00	20.0
.03	5.77	6 92	8 08	9 24	10.39	11.55	12 70	13 86	15.01	16 16	17.32	18 47	19.63	20 8	21.9	23.1
.02	7.07	8 49	9 90	11.31	12.73	14 14	15 56	16.97	18 38	19 80	21.21	22.63	24.0	25.5	26.9	28.3
.017	7.67	9 20	10 74	12.27	13.81	15 34	16 87	18.41	19 94	21.5	23.0	24.5	26.1	27.6	29.1	30.7
.014	8 45	10.14	11 83	13 52	15 21	16 90	18 59	20 3	22 0	23 7	25.4	27.0	28.7	30.4	32.1	33.8
.012	9.13	10.95	12 78	14.61	16 43	18.26	20.1	21 9	23 7	25 6	27 4	29.2	31.0	32.9	34.7	36.5
.010	10.00	12.00	14 00	16.00	18.00	20.00	22.0	24 0	26.0	28 0	30 0	32.0	34.0	36.0	38.0	40.0
.008	11.18	13 42	15 65	17.89	20 1	22 4	24 6	26 8	29.1	31.3	33 5	35.8	38.0	40.2	42.5	44.7
.006	12.91	15 49	18 07	20 7	23 2	25 8	28 4	31 0	33 6	36 1	38 7	41.3	43.9	46.5	49.1	51.6
.005	14.14	16 97	19 80	22.6	25 5	28.3	31.1	33.9	36.8	39 6	42 4	45.2	48.1	50.9	53.7	56.6
.004	15.81	18.97	22 1	25 3	28.5	31.6	34 8	37 9	41 1	44 3	47.4	50.6	53.8	56.9	60.1	63.2
.0035	16 90	20 3	23 7	27 0	30 4	33 8	37.2	40 6	43 9	47.3	50.7	54.1	57.5	60.8	64.2	67.6
.0030	18.26	21.9	25 6	29 2	32 9	36 5	40.2	43 8	47 5	51 1	54 8	58.4	62.1	65.7	69.4	73.0
.0025	20 00	24.0	28.0	32 0	36 0	40 0	44 0	48.0	52 0	56.0	60 0	64.0	68.0	72.0	76.0	80.0
0020	22.4	26.8	31 3	35 8	40 2	44 7	49.2	53.7	58.1	62.6	67 1	71.6	76.0	80.5	85.0	89.4
.0015	25.8	31.0	36 1	41.3	46.5	51 6	56.8	61.9	67 1	72.4	77.4	82.6	87.8	92.9	98.1	103.2
.0010	31.6	37 9	44 3	50.6	56.9	63.2	69 6	75 9	82.2	88 5	94 9	101.2	107.5	113.8	120.2	126.5
.0005	44.7	53.7	62.6	71.6	80.5	89 4	98 4	107.3	116 3	125 0	134 2	143.1	152.0	161.0	170.0	178.9

Lightning Arrester.

The accompanying illustration indicates the principle of a type of lightning arrester which formed the subject of a recent patent granted to Mr. Ernst J. Berg, of Schenectady, N. Y. It comprises an arrangement of condensers of the ordinary or electrolytic type for relieving the conductors from high frequency oscillation, and also a spark-gap and other elements for relieving the lines from disturbances of a lower frequency. The sketch shows the invention applied to a direct-current electric railway circuit of about 600 volts. The lightning arrester system is grounded and the line conductor connected to the motor through an impedance coil, shown at the top of the figure. Two condensers are placed in series in shunt with the reactance and have their common free terminals connected to ground.

The condensers serve the purpose of permitting a free path for any high frequency, high voltage oscillations and, therefore, reduce the potential gradient in the motor winding. The impedance causes a partial reflection point for the high voltage and, therefore, reduces the voltage on the motor winding.

The condenser should be constructed with as little inductive reactance as possible and the impedance as little capacity between turns as possible. The second path to the ground includes a spark-gap with a blow-out magnet (indicated to the left) arranged so that a direct and heavy discharge of energy may take place from the line conductor to the ground without passing through either of the condensers or through the impedance coil.



BERG LIGHTNING ARRESTER.

Curtis Turbine Tests.

Recently tests were made in England on a 1000-kw Curtis steam turbine supplied to the Lancashire United Tramways, Ltd., by the British Thomson-Houston Co., the tests being carried out under the supervision of Prof. Ernest Wilson, of King's College, London, and Mr. J. R. Salter, M. I. E. E., engineer and manager of the Lancashire United Tramways, Ltd. The turbo-alternator set consisted of a vertical Curtis steam turbine, mounted on sub-base condenser, running at a speed of 1500 r. p. m. and driving a two-phase alternator,

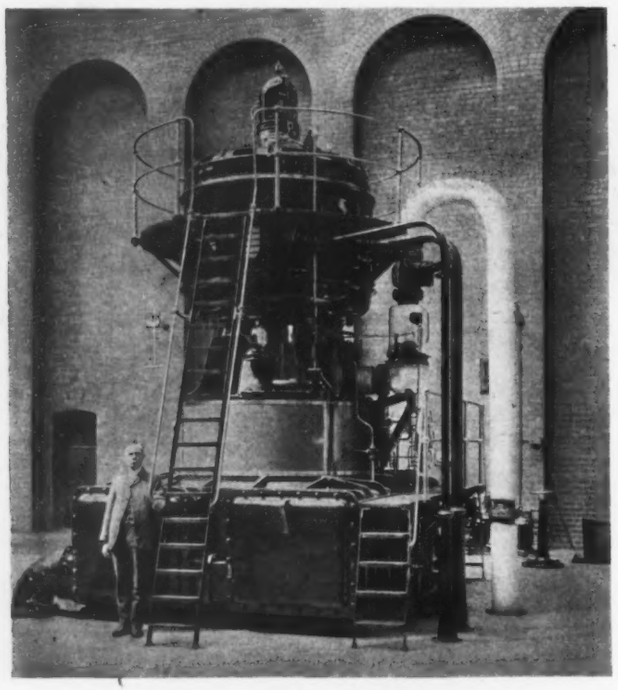


FIG. 1.—TURBINE ON SUB-BASE CONDENSER.

capable of giving a continuous output of 1000-kw (1250 kva) with 80 per cent power factor, the voltage being 7500 and the frequency 50.

The steam consumption tests were made by measuring the amount of water discharged into the hot well, the power taken by the air and circulating pumps being excluded. The test was run in the following order: Half load for 2 hours; full load for 6 hours; 1¼ load for one hour, after which the voltage regulation and insulation tests were taken.

In Table I is given a summary of the electrical data obtained during the run; Table II gives the steam consumption figures, and Table III the observed and calculated regulation.

The accompanying illustration shows the turbine set mounted on its sub-base condenser, with electrically driven air pumps, as erected in the power station of the Lancashire United Tramways Company at Atherton.

TABLE III.

Load	Where given	Regulation per cent from 7500 volts	EXCITATION		
			Amps.	K.W. in field coil	K.W. at 110 volts
No load	Specification		....		
	Tests	Nil	....	6.0	....
	Test	Nil	68	4.5	7.48
Full Load Non-inductive Cos θ = 1.	Specification	6.0		8.0	.....
	Test	5.75	75	5.6	8.2

The specification provided that the test for steam consumption should be made under the following conditions:

(1) A steam pressure of 150 lbs. per sq. in. at the stop valve.

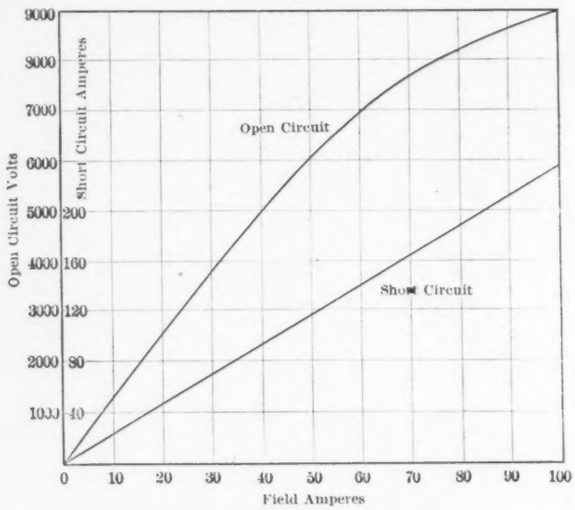


FIG. 2.—SHORT-CIRCUIT CHARACTERISTIC.

(2) A vacuum of 28 ins. with the circulating water at a temperature not exceeding 80° deg. F., and when the power absorbed by air and circulating pump motors does not exceed 52 kw.

The guarantees were as follows: For 1¼ load, 20 lbs.; for full load, 19.3 lbs.; for half load, 21.8 lbs. The full load figures were subject to a penalty or bonus of £50 for every one per cent variation.

TABLE I.

Tests	Average volts per phase	LOAD: Average Amps Phase 1	Average Amps Phase 2	Average K. W. from Watt Hour Meters Phase 1	Watt Hour Meters Phase 2	Average K.V.A. Phase 1	Phase 2	EXCITATION: Volts across field coil Start of Test	End of Test	Average Amps	K.W. in field Coil Start of Test	End of Test	Kilowatts at 110 Volts
Half Load..... 7500		33.7	33.5	....	....	252	251	60.5	66.5	69.5	4.17	4.65	7.65
Full Load 7500		66.7	66.4	506	505	500	498	71.0	75.0	75.0	5.31	5.63	8.25
1¼ Load 7500		85.4	85.0	643	638	640	637	79.5	81.0	79.4	6.29	6.45	8.73

TABLE II.

Time	Load	Steam: Pressure in lbs. per sq. inch	Steam: Temp. Deg.F.	Steam: Superheat Deg.F.	Exhaust vacuum	Barometer	Temperature of circulating water: In	Temperature of circulating water: Out	Lbs. of steam per hour	Kw-hours: Total Kw-hours	Kw-hours due to field coil	Nett Kw-hours	Lbs. or steam per Kw-hour
7.30 to 8.30 p. m. .....Half		153	384	18	28.65	29.60	35	47	9,650	503	4.65	498.4	19.4
9.36 p. m. to 2.06 a. m.....Full		153	389	22	28.82	29.66	35	51	17,100	1011	5.63	1005.4	17.0
2.30 a. m. to 3.30 a. m. .....Full		153	466	100	28.88	29.72	35	51	15,940	1011	5.63	1005.4	15.9
4 to 5 a. m.....1¼		148	508	145	28.77	29.72	35	54	19,390	1281	6.45	1274.6	15.2

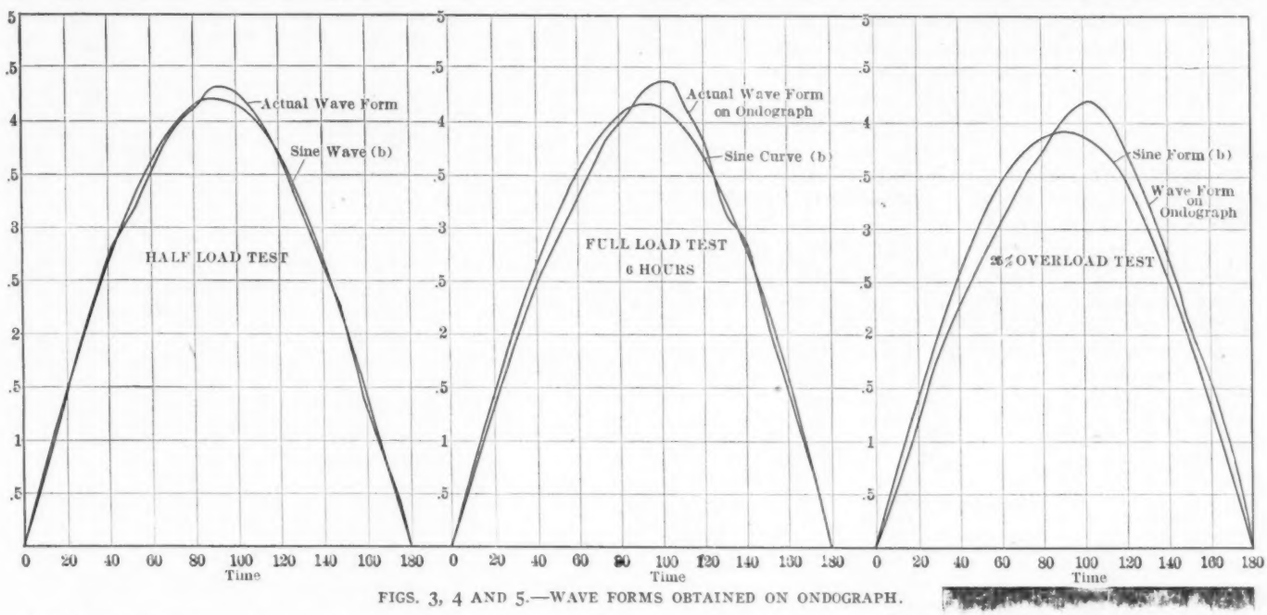
In each of the tests, the rate of consumption in pounds of steam per hour was obtained from the log sheets between the times set out in Table II, the tests being made by measuring the

amount of water discharged into two tanks. The platform weighing machines used during the test have been certified as accurate by the Government Inspector of Weights & Measures, and all electrical measuring instruments were calibrated by the Board of Trade after the test.

Correcting the test results at full load to specification conditions as regards steam pressure, superheat and vacuum, and allowing for excitation losses and lubricating pump (9.8 kw) the full-load figures worked out to 18.5 lbs. per kw-hour. This is 4 per cent better than the guarantee, which thus entitled the contractors to a bonus of £200.

The specification allowed a rise of 75 deg. F. (41.6 deg. C.) in temperature after a 10 hours' run at full non-inductive load. The rise observed was 39.2 deg. C. with relation to a thermometer in one part of the room, and 31.2 deg. C. with relation to a thermometer in another part of the room. In either case, the rise was within the specification limits. The temperature rises were checked by resistance measurements, and agreed closely.

It will be seen from Table III that the regulation was within the specification limits. The short-circuit characteristic (Fig. 2) enabled an approximate idea to be formed as to what the regulation will be on inductive loads. It will be seen that the field coil, according to theory, will have to be supplied with the full 110 volts for the requisite excitation of about 115 amperes when the generator is hot.



FIGS. 3, 4 AND 5.—WAVE FORMS OBTAINED ON ONDOGRAPH.

Figs. 3, 4 and 5, give the wave forms obtained by an ondograph and the equivalent sine curve has been superposed thereon. That is the curve marked *b* in each of the figures which would give the same reading on the same voltmeter that the actual curve gave. The deviation from a sine curve is not beyond the limit given in the specification, and is satisfactory. The deviation becomes more pronounced as the load is increased, on account of the increased armature reaction.

Possibilities of Electric Heating.

At the meeting, Sept. 9, of the Engineering Society of the Carolinas, Mr. Charles E. Waddell, second vice-president of the society, presented a paper entitled "Problems and Possibilities in Electric Heating." Referring to the electric heating apparatus now in the market, he states that one or more manufacturing companies guarantee for their product a life of 10,000 hours. The heating element consisting of a metal deposited on an enamel, which while very efficient in operation is open to the objection that the contact between the leading-in wires and the element is subject to deterioration eventually resulting in open circuit. More success in this respect has been realized with another type in which the heating element consists of a metal strip, similar to a Grecian border, whose terminals are an integral part of the strip itself and with greater carrying capacity. Depending upon the service the apparatus is to perform the current necessarily varies through wide limits in commercial apparatus. Thus in the case of the Vanderbilt Biltmore estate electric heating equipment, the plate-warmers are operated at a density of 0.8 watt per sq. in. of heating surface; the laundry mangle at 3 watts, and the iron stoves at 13 watts.

In the matter of switches, cut-out fuses, flexible cords and similar auxiliary appliances, the market to-day affords little choice. The requirements of heating apparatus are of the most exacting nature, and it is interesting to note in practice how quickly the "continuous carrying capacity" claims vanish when appliances so described are used with heating apparatus. The author stated that he had found it desirable to install switches, cut-outs and terminals of at least twice the capacity as rated by the manufacturers and to allow a generous margin in the capacity of fuses.

After discussing the general use of electric heating, the prospect for which is not found favorable, it was stated that in semi-domestic service the field is less restricted and the outlook more hopeful. For example, in laundries and large apartment houses there are many opportunities for economy from the use of electric heating. The Biltmore house is cited as an example of this kind. About a year ago a plant of about 160 kilowatts was installed there, superseding the high-pressure boiler that furnished steam for the laundry, plate warmers, etc., an ordinary type of hot-water heater burning anthracite coal, and a coal stove for the laundry irons. Three thousand gals. of water are heated to a temperature of 212 degs. F. per day of 24 hours, and except for heating the house, steam has been discontinued altogether. The success that has attended this initial installation leaves the hope that electricity may supersede steam for heating the house, a problem that is now being worked out.

The company furnishing electric power to the Biltmore estate offers favorable rates for service furnished between midnight and morning in the winter months, and the plan now being worked out is to heat large quantities of water between midnight and morning to a temperature higher than the boiling point, keep the water under pressure in containing tanks thermally insulated. Throughout the remainder of the 24 hours the water will be liberated into the present hot-water radiation system, and being under a very little pressure will expand, liberate its heat, condense and be returned to the tanks. Where direct-steam radiators are at present employed, as in the bath rooms and similar places, it is proposed to substitute di-

rect electrical radiators. With this system it is believed the operating cost would be the same as with coal, the fuel being anthracite that costs $11 per ton.

Control of Flywheel Motor-Generator Sets.

On Sept. 10 there were issued to Mr. W. H. Powell nine patents containing a total of 401 claims covering control systems for motors used in rolling mills. The main part of the motor equipment consists of an induction motor direct connected mechanically to a variable-voltage direct-current generator which is electrically connected to a variable-speed reversible motor, which drives the rolling mill machinery. The induction motor is provided with a variable secondary resistance so that it has a drooping load-speed characteristic. In order to equalize the load on the induction motor a heavy flywheel is mounted on its shaft for absorbing energy kinetically when the motor speed increases and for giving off energy when the speed decreases. The patents mentioned above relate not so much to the motor equipment as to the control system, the arrangement being such that the direct-current machines are not required to be of much, if any, greater rating than demanded by the load, because the maximum current and the maximum voltage are used simultaneously. Moreover, the time required for the reversal is rendered short on account of the small "time constant ($L \div R$) of the generator field magnet winding.

The armature of the working motor (connected to the rolling mill machinery) receives its energy from a special generator, and the field strength of both the motor and the generator are variable, generally inversely and preferably in alternate steps, while the field flux of the generator is reversible. The field current of the generator and also that of the motor are obtained from some external source. When it is desired to bring the working motor quickly to rest and reverse its direction of rotation, its field strength is first increased and the e. m. f. across its armature is reduced to zero; then its field is weakened and the e. m. f. impressed across the armature is simultaneously

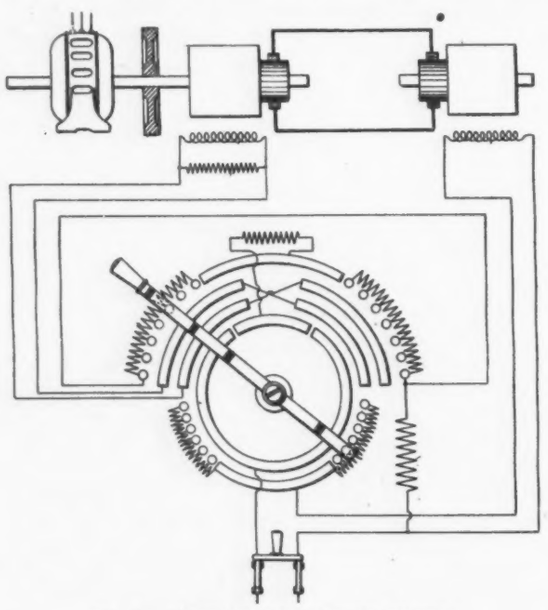


FIG. 1.—POWELL MOTOR CONTROL SYSTEM.

increased in a reverse direction. One method of arranging the apparatus and control circuits is shown in Fig. 1. Modifications described in other patents relate to self-contained exciting generators, and to the self-excitation or partial self-excitation of the direct-current machines.

Two patents containing a total of 78 claims covering additional modifications of the above system were issued on the above date to Mr. W. J. Richards. The scheme disclosed in one of these patents is shown in Fig. 2. The field coils of the direct-current generator A and the direct-current motor B are connected permanently in series and subjected to the full value of e. m. f. from an external source of supply. The currents in these sets of field coils are not maintained equal in value because the field coils of generator A are shunted by the armature of a "counter-voltage" generator C. The speed control of the whole equipment is obtained by varying the field strength of generator C. When the field circuit of this generator is open, the armature C generates almost no counter volt-

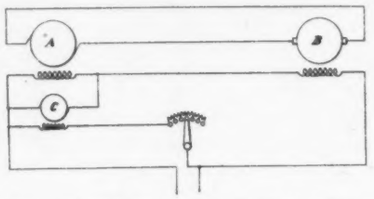


FIG. 2.—RICHARDS MOTOR CONTROL SYSTEM.

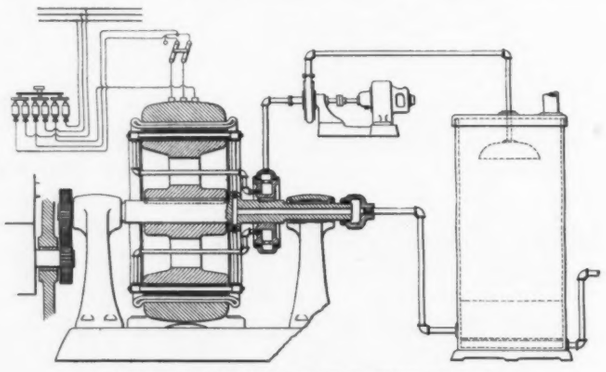
age, and its resistance being very low, almost no current passes through the field coils of generator A. The field current of motor B has its maximum value, but the armature exerts almost no torque because its current is of almost zero value. When the field strength of C is gradually increased more current passes through the field coils of generator A (less through the field coils of motor B) and it delivers a gradually increasing e. m. f. to the armature of motor B. In the second patent issued to the same inventor, the field coils of motor B are also shunted by the armature circuit of a "counter-voltage" generator, the e. m. f.'s of the two "counter-voltage" generators being separately controlled by manually operated field-circuit rheostats.

In a patent containing 46 claims, issued to Mr. L. E. Bogen on the same date, it is proposed to supply current to the field coils of the working motor, and of the generator supplying current to the armature of this motor, from separate sources of e. m. f., and to vary the e. m. f.'s of the separate sources inversely in order to control the speed and power of the working motor.

All of the above-mentioned 12 patents have been assigned to the Allis-Chalmers Company.

Artificial Cooling of Induction Motors.

Means for artificially cooling the rotor windings of an induction motor for driving rolling mills are disclosed in a patent



ARTIFICIAL COOLING OF INDUCTION MOTORS.

issued Sept. 10 to Dr. C. P. Steinmetz. The secondary (rotor) winding consists of a "squirrel-cage" whose bars are made of piping and whose end rings are hollow. Cooling water is drawn through the bars and end rings by means of a suction pump. The water being under a partial vacuum, a leaky joint merely admits air instead of allowing the water to escape. The secondary resistance is so high that the maximum torque occurs at about negative synchronism (at a slip of 200 per cent). The motor is, therefore, especially suited for work requiring

rapid reversal of rotation. The artificial cooling allows the rotating member to be extremely small and its inertia correspondingly low.

New Telephone Patents.

SUPERVISORY CIRCUIT.

All lamp supervisory circuits have included two elemental principles, viz., the initial control device which keeps the circuit inoperative except when the associated cords are in use, and the responsive device which effects the actual display of the signal. Usually the control part maintains the lamp signal open, it itself being normally on open circuit. Contrary to this custom, Mr. W. W. Dean has provided for the control a relay normally on closed circuit, which relay maintains the lamp circuit open in its energized condition. This relay becomes deenergized during the use of its cord circuit by any of the ready means. The control relay is, of course, wasting energy continuously, but the resistance is made some thousands ohms. The patent for this circuit is assigned to the Kellogg Switchboard & Supply Company.

INDUCTION COIL CIRCUIT.

D. M. Therrell, of Charleston, S. C., has obtained an additional patent on his resonance induction coil arrangement for improving transmission. Notice of his earlier patent, which sets forth the general principles, was given on page 831 of our issue of April 21, 1906, and an exposition of the principles and their application will be found in an article by Mr. Therrell on page 1344 of our issue of June 30, 1906.

AUTOMATIC SWITCH.

A novel sort of automatic switch forms the basis of a patent issued to H. G. Pope, of New York City. The switch is associated with the band of a head telephone so that when this clamps the head of the user the switch is closed. It may either be at the receiver end of the band, or in connection with a pad at the free end.

LETTERS TO THE EDITORS.

Apropos of the Niagara Illumination.

To the Editors of Electrical World:

SIRS:—It is with interest that the writer has read the description of the steam fountain apparatus installed in connection with the illumination of Niagara Falls, illustrated in the Sept. 7 issue of the ELECTRICAL WORLD. Therein it is stated that the apparatus was designed for the Jamestown Exposition, but not used for various reasons.

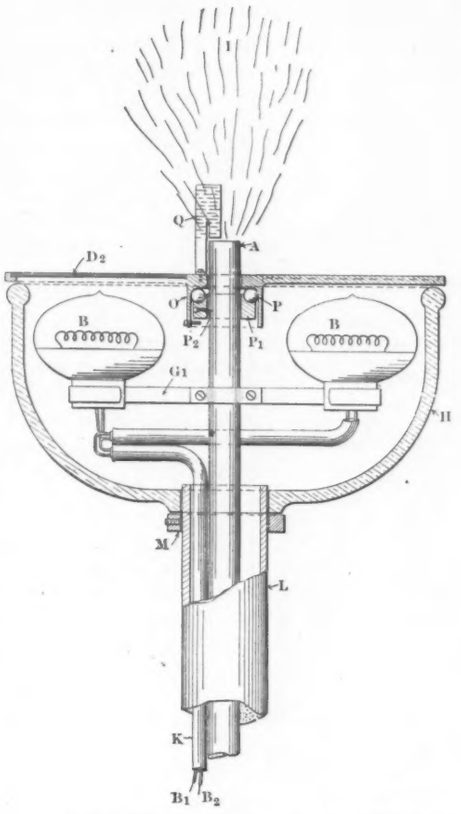
This means of spectacular illumination occurred to the writer some time in 1905. Application for a patent on a steam fountain head, illustrated by a sectional view in the accompanying diagram, was filed in the spring of 1906; and shortly thereafter the writer endeavored to induce the Jamestown Exposition authorities to adopt on a large scale a spectacular scheme of steam fountain lighting.

In the particular type of fountain head here illustrated, *A* is the nozzle of a pipe from which a low pressure steam jet *I* discharges. Rigidly attached to the pipe are the lamps, *B, B,* receiving current through the conductor *K*.

A transparent rotatable color disk D_2, carrying two or more colored sectors, is mounted on a center bearing supported by the steam pipe at P_2. A thin metal vane *Q* attached to the disk D_2 slightly projects over the nozzle so that the escaping steam will impinge against the vane, thus causing a pressure tending to slowly rotate the color disk. The entire mechanism is enclosed by the metal or porcelain shield *H* and the outer tubing *L*. The operation of the device is simple and automatic, and slowly shifting color effects are continuously obtained.

It was proposed to place a number of these fountain heads along cornices of certain of the exposition buildings, or on either side of the esplanade. A large central fountain was also proposed with powerful light reflecting thereon.

In view of the foregoing the writer believes himself entitled



ILLUMINATED STEAM FOUNTAIN HEAD.

to share in what small credit may be due to originating and introducing the luminous steam fountain.

NEW YORK. P. G. WATMOUGH, JR.

Distortion in Telephonic Transmission.

To the Editors of Electrical World:

SIRS:—In your editorial comment on my paper "Distortion in Telephonic Transmission," I note the following statement: "We note that in the present case, as in the case of other writers on the subject of telephonic distortion, the term distortion is connected only with the effect of attenuation. This use appears to ignore the fact that the effect of reactance not only attenuates differently the values of current components, but also changes their phase relations." If you will kindly refer to my paper on the "Telephone Repeater," published in your journal April 4, you will find that I specifically called attention to the fact that the phase displacement is one of the causes that produce distortion. The reason I did not mention anything about it in this paper is because I did not intend to deal with the problem of distortion in all its phases. I merely wished to call attention to the fact that resistance is a function of the frequency and this produces distortion. To make the argument clear I made some calculations to show to what extent the attenuation is affected by the change of resistance. It is understood, of course, that the phase displacement will be similarly affected, but I did not think it necessary to consider both factors which enter in the production of distortion. I thought that the discussion of one factor—attenuation—would be sufficient to illustrate the argument.

WASHINGTON, D. C. LOUIS COHEN.

DIGEST OF CURRENT ELECTRICAL LITERATURE.

Dynamos, Motors and Transformers.

Single-Phase Motor.—A well-illustrated account of the development of the Siemens-Schuckert single-phase commutator motor for traction purposes, on the basis of various papers by R. Richter. The motor is of the series type but differs from the ordinary series motor chiefly with respect to two features. The first of these features relates to an arrangement of the armature winding, whereby the high resistance leads, before reaching the commutator, are arranged in extra turns so situated as regards the impressed field as to contribute materially to the torque of the motor. It is claimed that some 10 per cent increase in the output for a given weight of motor is obtained by virtue of this construction. The stator windings differ from those customary with the series-type motor, chiefly with respect to certain special connections, which give to a portion of the windings a certain amount of shunt characteristic, subsidiary, of course, to the predominating series characteristic. This arrangement has been introduced with a view to suppressing still further the sparking at starting due to the transformer action from the main poles. Motors of this type rated at 125 hp are already in use on the Blankenese-Ohlsdorf Railway, and motors of 175-hp rating will be employed on the Heysham electrification scheme of the Midland Railway. This latter type of motor has a speed (at its 1-hour 75-deg. C. rating) of 700 r. p. m., and weight 2.77 tons. The weight of the remainder of the electrical equipment is 2.73 tons per motor, thus giving a total weight of electrical equipment of 5.50 tons per motor. The motors are ventilated by forced draft. If they were non-ventilated, and were run at a speed of 550 r. p. m. (which is more in accordance with approved railway practice) the total weight of electrical equipment would amount to some 7 tons, or some 40 kgs. per rated horse-power, as against some 17 kgs. per rated horse-power for first-class continuous-curent equipment for the same rating.—Lond. *Elec. Eng'ing,* Sept. 5.

Dimensions of Dynamos.—H. M. Hobart and A. G. Ellis.—The first part of an illustrated article on a method of determining the leading dimensions of large and high-speed continuous-current dynamos. In large and high-speed dynamos, especially for large rated outputs associated with high speeds, the commutation problem is the most difficult, while that of the losses and heating is less important. The method described by the authors embodies a general relation between the leading dimensions, armature strength, number of poles, rated output and speed, and the commutating quality. The latter is expressed in terms of the reactance voltage per segment.—Lond. *Elec. Review,* Sept. 6.

Repulsion Motor.—A note on a recent British patent of the Allgem. Elek. Ges. It relates to alternating-current machines whose magnetic field is excited by a rotor short-circuited through a commutator and brushes. In order to distribute the field more uniformly over the air-gap, the exciter brushes are arranged in a chord perpendicular to the short-circuit axis. Two sets of brushes may be employed on two chords, one on either side of the ordinary central position. A chord winding on the rotor may also be used in conjunction with brushes arranged as a chord.—Lond. *Elec. Eng'ing,* Aug. 29.

Automatic Speed-Control of Series Motors.—A note on a recent patent of Burnand. In order to vary at will the speed of a series-wound motor, the positions of the brushes are controlled by means of an eddy-current brake, one member of which is driven by the motor shaft, the other member of the brake is movable within certain limits, and its movement is controlled by a spring adjustable by hand. The movement of the brake mechanism is arranged to rock the brushes by means of a pinion and sector. Normally, the torque of the brake balances the pull of the control spring, but when the speed varies the torque varies, and the brushes are moved in either direction until the speed is restored to practically normal. —Lond. *Elec. Eng'ing,* Aug. 29.

Commutator Construction.—An illustrated description of mechanical details of fixing the commutator segments, recently patented by the Siemens-Schuckert Co.—Lond. *Elec. Eng'ing,* Sept. 5.

Traction.

Statistics.—The yearly statistical table on street and elevated railways in the United States and Canada. In the United States there were 1164 railway companies in 1906, operating street or elevated railways, with a total track mileage of 36,932, of which 719 track miles are operated by cable, steam or horses and the balance of 36,212 by electricity. The total capital stock was $2,039,948,875, the funded debt $1,725,369,000 and the capital liabilities $3,765,317, 875. Data are also given on the insular possessions of the United States, on Cuba and on Canada.—*St. R'y Jour.,* Sept. 7.

Contact Resistance.—P. M. Hall, P. C. Smith and C. B. Starbird.—An account of an experimental investigation of contact resistance in connection with rail bonding. Most of the results are given in diagrams. One of the objects of the tests was to determine the pressure of the rail bond against the steel rail which gives the best resistance value. This pressure was found to be from 25,000 to 30,000 pounds per square inch of contact surface. This pressure is within the elastic limit of steel; consequently steel does not take a permanent set when it is applied. It does not pay to increase the area of the bond terminal unless the pressure applied in the bond terminal is correspondingly increased; that is, if the contact surface of the bond terminal is doubled, it is necessary to double the pressure applied to the bond before any appreciable difference in contact is obtained. The contact resistance between annealed cast copper and steel is from 30 to 60 per cent higher than the resistance between annealed rolled copper and steel.—*St. R'y Jour.,* Sept. 14.

Surface Contact System.—An abstract of the last annual report of the municipal tramways of Wolverhampton where the Lorain surface contact system is in use. From the balance sheets it appears that the cost of electric energy has decreased from 3.982 cents to 3.686 cents per car-mile, while the cost of maintenance of the Lorain equipment has increased from 0.444 to 0.704 cents per car-mile. This increase is due to an increase in the cost of maintenance of the Lorain track equipment from 0.204 to 0.270 cents and to an increase of maintenance of car equipment from 0.24 to 0.434 cents per car mile.—Lond. *Elec. Eng'ing,* Aug. 29.

St. Petersburg.—An illustrated description of the electric tramway system of St. Petersburg. It is supplied from a new generating station containing three turbo-alternators which give a three-phase supply at 6600 volts to five rotary-converter sub-stations.. The line equipment is overhead and the route is of double track, 5-ft. gauge. Single deck two-axle cars are used with trailers.—Lond. *Electrical Engineering,* Aug. 29.

Single-Phase Traction.—An illustrated description of the rolling stock of the single-phase Vienna-Baden interurban line. As has been noted in the Digest, the electrical car-equipment is adapted for use on both single-phase and direct-current circuits. Full details of the controlling and brake systems are given.—Lond. *Electrician,* Aug. 30.

Standardization.—A report prepared for the recent convention of the German Street & Interurban Railway Association on standardization. Among the subjects treated are axles, journal boxes, tracks, brake-shoes and gearing.—*Street R'y Jour.,* Sept. 7.—The report on standardization of rail sections presented at the same convention suggests the standardization of 15 rail-sections, composed of five sizes each, for grooved, composite and T-rails respectively.—*St. R'y Jour.,* Sept. 14.

Glasgow.—An abstract of last year's report of the Glasgow tramway system which is one of the oldest municipal tramway systems in England, having been acquired in 1894. The total mileage is 176, of which 109 miles are within the city of Glasgow. The total expenses including capital charges per car-mile were 19.550 cents while the total income from all sources was 21.212 cents.—Lond. *Elec.*, Aug. 30.

Sunderland.—An abstract of the last annual report of the municipal tramways of Sunderland which comprise two miles of single track and nine miles of double track. The total expenses, including capital charges, per car mile were 15.638 cents, the total receipts from all sources 22.846 cents.—Lond. *Electrician*, Sept. 6.

Electrophysics and Magnetism.

Inductance.—K. OGURA AND C. P. STEINMETZ.—A mathematical paper on the inductance of straight conductors, giving formulas for infinitely long straight conductors and for straight conductors of finite length, and also for the mutual inductance of two finite straight conductors at considerable distance from each other.—*Physical Review*, September.

Pinch Phenomenon.—P. BARY.—An illustrated translation in abstract of his French paper abstracted some time ago in the Digest, on the mechanical action of currents on conductors.—Lond. *Electrician*, Sept. 6.

Rays of Positive Electricity.—J. J. THOMSON.—The author has formerly shown that the rays of positive electricity in gases at very low pressures consist mainly of streams of two kinds of positively charged particles, the value of the ratio of electric charge to mass for one stream being 10,000 and for the other 5000. As these are respectively the values of the ratio of charge to mass for charged atoms and molecules of hydrogen, it might be thought that the rays of positive electricity are dependent on the presence of hydrogen in the discharge tube. However, this seems not to be the case, and experiments now described by the author show that the intensity of rays in different gases is not connected with the amount of hydrogen in the tube. He also found that positive rays are very widely distributed throughout the tube. The positive rays are to be found throughout the whole tube and not merely passing through apertures in the cathodes and in the layer of luminosity adjacent to it. The particles of positive electricity are shot off in all directions from a gas traversed by canal rays.—*Phil. Mag.*, September.

Ionization by Spraying.—A. S. EVE.—Since Lenard discovered the presence of negative electrification near water falls much work has been done on the generation of electricity by the splashing of liquids and by bubbling gases through them. The author has studied especially the electrical effects due to spraying. While making some experiments with an Ebert apparatus for measuring the ionization of the atmosphere, he blew with an ordinary garden hand sprayer a very fine mist all around the apparatus. The number of ions detected in the atmosphere was thereby increased many thousands. Negative ions were in excess of the positive and their ratio was about 1 to 4. The author has now studied this problem with more refined apparatus.—*Phil. Mag.*, September.

Radioactivity and Roentgen Rays.—A note by W. Wilson and W. Makower on the rate of decay of the active deposit from radium, and a paper by C. G. Barkla and C. A. Sadler on secondary X-rays and the atomic weight of nickel. Curves connecting the atomic weight of an element subject to X-rays and the general penetrating power of the secondary X-rays emitted by it (various absorbing substances being used) indicate for nickel an atomic weight of about 61.4.—*Phil. Mag.*, September.

Ether.—LORD KELVIN.—A highly theoretical paper on the motions of ether produced by collisions of atoms or molecules containing or not containing electrons.—*Phil. Mag.*, September.

N-Rays.—G. F. STRADLING.—A useful résumé of the literature of the N-rays, the N_1-rays, the physiological rays and the heavy emission, with a bibliography.—*Journal of the Franklin Institute*, Aug. and Sept.

Electrochemistry and Batteries.

Fixation of Atmospheric Nitrogen.—F. HOWLES AND N. WHITEHOUSE.—Two papers on the fixation of atmospheric nitrogen in form of useful compounds. Howles gives a critical review of the different processes which have been proposed for the electrothermic combustion of atmospheric nitrogen. The conditions which must be fulfilled for successful operation are summed up by him as follows. The ordinary high-tension arc consists of three superimposed zones. In the lowest and hottest zone the oxidation of the nitrogen takes place, and in order to get a high efficiency it is important to get as high a temperature in this zone as possible. On the other hand the relative values of the second and third zones should be reduced as much as possible and the produced gas mixture should be removed from the sphere of influence of the arc as quickly as possible. A further important consideration is the concentration of large amounts of energy in a unit of plant. In the final part of the paper the author indicates as two elements of improvements which may be made, an increase in the flame temperature and the more rapid removal of the nitric oxide from the arc by means of greater air velocity and without increased dilution. These two effects could be obtained by treating compressed air in the arc. In the final part of the paper the absorption of nitric oxide and the proportion of nitric acid is discussed, and it is said that although the electrochemical production of nitric acid has attained a fair degree of efficiency in some processes, the problem of directly manufacturing from the furnace gases a 98-per cent acid has not yet been solved. The paper of Whitehouse deals with an experimental investigation on a cyclic process using a metal which is first made to combine with the nitrogen in the air so as to form a nitride, whereupon the nitride is reduced by means of hydrogen so as to recuperate the metal with simultaneous production of ammonia; but it is found that none of the known metals fulfills the required conditions.—*Electrochem. and Met. Industry*, September.

Corrosion of Iron.—A. S. CUSHMAN, W. H. WALKER, A. M. CEDERHOLM AND L. N. BENT.—Two papers on the corrosion of iron as an electrochemical phenomenon. Both papers show that the carbon dioxide theory cannot be satisfactory since the presence of carbon dioxide is not necessary for the corrosion of iron. In a crucial experiment on the electrochemical theory the fact is established that iron dissolves in water which contains not more than a trace of electrolyte, no oxygen and no carbon dioxide. The dissolving of iron in the moisture is the first step, while the second step is the oxidation of the ferrous ions to ferric by oxygen of the air. The loose colloidal ferric hydroxide thus produced moves towards the cathode under the influence of the current and piles up there in the form of rust. The function of oxygen in the corrosion of iron is double. The secondary function is, as just explained, the oxidation of the ferrous ions. According to Walker, however, oxygen also must fulfill a primary function, namely to depolarize those cathodic portions of the iron upon which hydrogen tends to precipitate. Both Cushman and Walker have developed an indicator which shows to the eye where the cathode and the anode zones are on an iron surface. This is described in detail. There are two possibilities to limit rusting. The first is to make the iron so pure and to guard against unhomogeneity and bad segregation to such an extent that galvanic couples are not likely to be formed. The second method is to use the present commercial kinds of iron and steel and protect them by a coating such as a dilute solution containing bichromate. The subject is also discussed in a long editorial.—*Electrochem. and Met. Ind.*, September; The full paper of Cushman is published as Bulletin 30 of the Office of Public Roads, *U. S. Dept. of Agriculture.* The full paper of Walker is published in the *Journal American Chemical Society*, September.

Units, Measurements and Instruments.

Standard Magnetic Field.—R. GANS.—If magnetic fields could be reproduced like capacities, resistances, or inductances, it would mean a great convenience in magnetic measurements. An approach to such a desideratum is provided by standard

solenoids free from iron, which may be traversed by standard currents to give standard fields. The disadvantages are that the fields are weak, inaccessible and lacking in uniformity. This could be largely remedied by introducing iron cores, but not without introducing hysteresis and a lack of proportionality between current and field. The author indicates a method of avoiding these sources of error. Hysteresis is eliminated by introducing the current by small steps with reversals, and a proportionality between current and induction may be obtained at maximum permeability, where the tangent to the BH curve from the origin coincides with the curve itself for some appreciable distance. The author used a gapped ring of well-annealed wrought-iron rich in carbon, 62 cm. in circumference, with a gap of 0.6 cm. The formula connecting the field H in

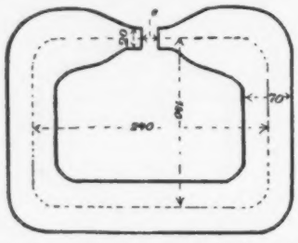


FIG. 1.—STANDARD MAGNETIC FIELD.

the gap with the current i in amperes was $H = 1348i$. The proportionality, however, only held good between 1.5 and 2.4 amperes, and varied with the direction of the magnetizing current. A better result was obtained with a ring with tapering pole-pieces, especially when made of soft cast steel. One such ring with 1700 turns and of the construction shown in Fig. 1 gave fields ranging from 3000 to 10,000 units, according to the magnetizing current, and these did not vary more than 0.2 per cent in one year.—*Phys. Zeit.*, Aug. 15, abstracted in Lond. *Elec. Engineering*, Sept. 5.

Energy Losses in Condensers.—W. Eickhoff.—When the voltage between the two plates of a condenser is increased to a certain degree, fine brush discharges take place; for instance, in Leyden jars they pass from the rims of the condenser plates over to the glass surface. In the moment in which an arc passes through the air gap in the circuit, starting the high-frequency oscillations within the circuit, there is a strong brush light along the surface of the dielectric. This, of course, represents a certain loss, and the author emphasizes that the loss is by no means negligible compared with the loss in the spark. The brush light also causes a certain distortion of the resonance curve. With the condensers used by the author, in order to get sharp resonance, he connected them in series when the total voltage was beyond a certain limit. The lack of sharpness of resonance is not simply caused by the energy loss, but is primarily due to the variations in the frequency produced by the brush discharges.—*Phys. Zeit.*, Sept. 1.

Universal Instrument for High-Frequency Currents.—E. Nesper.—The conclusion of his illustrated description of a universal instrument for high-frequency currents and oscillations. In the present installment the application of the instrument to measurements of the damping of an oscillator and to the measurement of the damping of a resonator are described. —*Elek. Zeit.*, Sept. 5.

Telegraphy, Telephony and Signals.

Sounder.—An illustrated description of a new direct-reading polarized sounder invented by C. C. Vyle of the British Post Office. It can be placed directly in the line circuit without any relay or local battery and, with currents of from 4 to 5 milliamperes, gives firm, readable signals. With the exception of four terminals in place of two, the instrument is made to resemble in appearance the ordinary single-current pony sounder, the feet being provided with fixing holes at exactly the same centers as in the ordinary instrument. The winding is differential, and, as the result of a long series of trials with a view to finding the best value for practical work, each coil has been wound to a resistance of 500 ohms. For simplex working the coils can be joined in series with a total resistance of 1000 ohms, or in parallel, the resistance then being 250 ohms. When in use on duplex circuits, the inner terminals of the sounder are strapped together, the Vyle sounder being joined up in circuit in place of the ordinary relay. The chief feature of the instrument is the permanent magnet which is placed in the base and connected to the cores of the electromagnet. The interposition of a permanent magnet in the magnetic circuit with a view to reinforcing the electromagnetic action produced by the signalling current is interesting, particularly in view of the fact that by means of this arrangement condenser working on the leak principle is possible. The inductive effect of the permanent magnet on the cores of the electromagnet results in the armature being attracted, this force of attraction being overcome by the tension of the antagonistic spring. If the latter is in excess of the former the instrument works in the ordinary manner. If, however, the effects due to the spring tension and to the permanent magnet are equal, a remarkable result is obtained. The passage of a very small current will disturb the balance and the armature commences to descend. Now the force due to the spring tension varies as the displacement, while the force due to the magnetic attraction varies as the fourth power of the displacement. As the armature descends, therefore, the force of the permanent magnet rapidly increases its effect, and the momentum increases accordingly, the lever finally strikes the lower stop with sufficient energy to give a firm, readable signal. If the marking current is followed by a spacing current, the reverse conditions obtain; the spring tension falls off at a much slower rate than the magnetic force, the armature gaining momentum during the whole of the upward movement. It will be seen that the energy necessary to work the instrument is brought into action by a small external force under the control of the transmitting station. It is this property that enables the Vyle sounder to be worked on those circuits which it is necessary to work by small impulsive currents through a condenser or transformer. In such systems there is, of course, no permanent current on the line, and the sounders are adjusted to their most sensitive condition. The initial part of the signal—say, a dash—is formed by a momentary current in one direction, and terminated by a current in the reverse direction, the armature being held down for the formation of a dash by the attraction of the permanent magnet. The simplicity obtained by the use of the instrument is apparent from Fig. 2, which shows the connections for a simplex

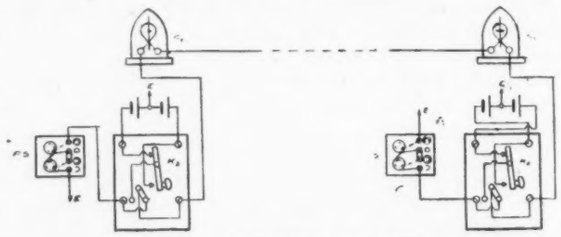


FIG. 2.—DIRECT-LINE SOUNEDR.

double-current circuit working from a split battery. The absence of the relay will be noted; the employment of the single-current key with switch enables a number of circuits at each station to be worked from a split battery. Since the sounder can be worked through condensers, it is specially valuable in preventing disturbances occasioned by the leakage of currents or magnetic storms. The sounder has also been designed to possess a high inductance which renders it insensible to inductive disturbances whether electrostatic or electromagnetic.—Lond. *Electrician*, Aug. 30.

Wireless Telegraphy.—C. A. Culver.—An account of an experimental investigation in which the author studied the relative efficiency of several different types of receiving systems for wireless telegraphy when used under various conditions. The chief results are as follows: The resistance of the earth between the two stations is an important factor in the propagation of energy. The square of the energy received by a horizontal antenna is approximately proportional to its length.

as proper to work without gloves, unless they were working on a "bad pole." The court concluded that it would not be justified in saying under the evidence that it was conclusively negligent on the part of the lineman to work where he was at the time of the accident, depending on the insulation afforded by the dry pole without wearing rubber gloves. And so far as the telephone company was concerned, it was wholly immaterial what were the rules of the light company, or whether such rules had been observed. The telephone company offered as a further defense that the administrator had settled with the light company, and, therefore, had no cause of action against the defendant. It was shown that the light company had paid $1,200 to the administrator, and the plaintiff admitted the receipt of that sum of money, but averred the same to have been a gift or gratuity voluntarily paid, without solicitation, and without any demand or claim. The document which he signed purported to accept the $1,200 in full of all claims against the electric light company. The rule is that where two persons are jointly liable for the same negligent act, a settlement with one of them operates as a release to the other. It was immaterial whether the plaintiff had made a claim against the light company on account of the death, or whether the manager of that company first approached him, and suggested the payment of the money. The question was whether the plaintiff had received from the light company by voluntary settlement full compensation of any demand which he could have made against the light company for the death of the lineman. This he was held to have done, and for that reason could not later bring suit against the other negligent party upon the same cause of action. Snyder vs. Mutual Telephone Company, Supreme Court of Iowa, 112 N. W. Rep. 776.

Obituary.

MR. E. E. BLACKMER, electrical engineer for the Des Moines Edison Electric Light Company, died recently from injuries received Aug. 27. Mr. Blackmer had been with the above-named company about 10 years.

PROF. GEORGE W. PLYMPTON, professor of physical sciences at the Polytechnic Institute in Brooklyn, died on Wednesday, Sept. 11, at his summer home in Tyson, Vt., in his eightieth year. He was born in Waltham, Mass., and graduated as a civil engineer from the Troy Polytechnic Institute in 1847. He was in the service of the Government as an engineer during the Civil War. In 1851 he became a professor of mathematics in the New York State Normal School, and in 1860 held the same position in the New Jersey Normal School. His connection with the Brooklyn Polytechnic Institute began in 1863. He was professor of chemistry and toxicology for several years in the Long Island College Hospital, and from 1870 till 1886 was editor of Van Nostrand's *Engineering Magazine*. He had been director of schools in the Cooper Union for thirty-eight years. He was president of the Board of Electrical Subways in Brooklyn during Mayor Low's administration and was a member of the Society of Civil Engineers. He leaves a son, Dr. Henry Plympton, a Brooklyn physician, and two daughters. The interment was at Troy, N. Y.

Personal.

MR. J. P. JOHNSTON has resigned as manager of the water-tube boiler department of the Atlas Engine Works, Indianapolis. Mr. Johnston's present address is Engineers' Club, New York.

MR. CHARLES N. BLACK has been appointed general manager of the United Railways of San Francisco, and has resigned his position as general manager of the Metropolitan Street Railway of Kansas City.

MR. FRANK B. BATCHELDER has been appointed acting superintendent of motive power of the United Railways & Electric Company, of Baltimore, Md., having charge of the operation of the power plants and substations.

MR. LUCIUS T. GIBBS has been appointed electrical engineer of the Baltimore & Ohio Railroad, succeeding Mr. W. D. Young, resigned. Mr. Gibbs is brother of Mr. George Gibbs, general superintendent of motive power of the Pennsylvania Railroad.

MR. JAMES L. RICHARDS, president of the subsidiary companies of the Massachusetts gas companies, has been elected president of the subsidiary companies of the Boston Suburban Electric Companies, to succeed Mr. Samuel L. Powers, who resigned to devote all his time to the practice of law.

MR. F. S. NICHOLSON, superintendent of the electrical department of the Elmira Water, Light & Railroad Company, of Elmira, N. Y., has been appointed superintendent of the Oswego Electric Lighting Company, of Oswego, N. Y. Mr. J. W. Cunningham succeeds Mr. Nicholson and has already assumed his duties.

MR. L. J. B. WALL, of Perth, West Australia, has become interested in colliery development in West Australia. The firm of which he is the engineer member—Splatt, Wall & Company—has purchased extensive coal workings about 100 miles from the coast, and the plans for their operation involve the exclusive use of electricity for power. Mr. Wall is a member of the A. I. E. E.

DR. WALTER REICHEL, formerly chief engineer of the railway department of the Siemens & Halske Company, and now professor at the Berlin Polytechnic University, is on a visit to this country as a member of a Prussian Government commission, which will report on the subject of heavy electric traction as applied here. The name of Dr. Reichel is well-known in connection with the Zossen high-speed and high-voltage railway tests.

MR. LEROY P. SAWYER, manager of the Buckeye Electric Company, will shortly become a benedict, his engagement to Miss Jessamine Pike having recently been announced. The prospective bride is well known in Cleveland, having been the leading singer at the Unity Church there for some years. Mr. Sawyer is a graduate in electrical engineering from the University of Nebraska, and in view of the executive ability he has shown in the management of the Buckeye Electric Company, has been placed upon a number of the governing committees of the National Electric Lamp Association.

Trade Publications.

DIRECT CURRENT GENERATORS of the belted type are fully discussed in Bulletin No. 1094 of the Fort Wayne Electric Works, Fort Wayne, Ind.

ELECTRIC HOISTS.—The Lidgerwood Manufacturing Company, 96 Liberty Street, New York, has issued an illustrated bulletin dealing with electric hoisting equipments for 250 and 500 volts.

TURBO-GENERATORS FOR TRAIN LIGHTING.—Bulletin No. 4509 of the General Electric Company deals with Curtis turbo-generators designed for mounting either upon the locomotive or in the baggage car. The bulletin contains a list showing 57 trains upon which 15-kw, 80-volt and 25-kw, 125-volt Curtis turbine sets are now used.

PLUNGER PUMPS.—The Goulds Manufacturing Company, Seneca Falls, N. Y., has issued an attractively illustrated booklet dealing with triplex pumps for heavy duty driven by electric motors. The booklet contains illustrations of the many services to which the pumps are applied, and shows many buildings equipped with Goulds pumps.

ARC LAMPS.—Circular No. 1102A, of the Westinghouse Electric & Mfg. Company, is devoted to direct-current multiple-circuit arc lamps designed for either 110 or 220. The lamps are of the direct-lift type, the pull of the magnets being directed upward; and the mechanism is so arranged as to secure a uniform and even action during the entire lift.

BLOWERS AND EXHAUST FANS.—Direct connected electric forge blowers are discussed fully in bulletin No. 3304 of the Emerson Electric Manufacturing Company, St. Louis, Mo. The motors are of either the direct-current or alternating-current type. Exhaust fans direct connected to alternating-current or direct-current motors are treated in bulletin No. 3503 of the same company.

ELECTRICAL HEATING DEVICES.—The Lowe Electrical Company, 54 Vesey Street, New York, in a 12-page pamphlet, describes its line of Conqueror electric heating devices. These are of the iron-clad type and interchangeable, and are claimed to be indestructible. Among the apparatus illustrated are laundry irons, disk stoves and circuit attachments for electric heating apparatus.

PORTABLE TESTING INSTRUMENTS.—Circular No. 1104 of the Westinghouse Electric & Manufacturing Company deals with portable voltmeters, milli-ammeters, lamp testers, volt-wattmeters, ammeters, single-phase wattmeters, polyphase wattmeters, single-phase power-factor meters, polyphase power-factor meters and portable series and shunt transformers for use with measuring instruments.

MILLWORK.—Under the title of "Some Mill Engineering Work," Mr. Frank Sutton, E. E., of 91 Wall Street, New York City, has issued a neat pamphlet addressed to mill owners and giving a list of the various mills, factories and other places for which he has undertaken the design and equipment of their power plant, sprinkler system, etc. The list is very long and comprehensive in its range.

SPECIAL-SERVICE, DIRECT-CURRENT MOTORS.—Constant-speed motors of the four-pole type rated at from 2-hp to 10-hp and two-pole motors rated at from .16-hp to 1.5-hp are discussed fully in circular No. 1099 of the Westinghouse Electric & Mfg. Company. Motors rated at from 25-hp to 150-hp and intended for heavy mill service are treated at length in bulletin No. 1144 of the same company.

ELECTRICAL MACHINERY.—The September "bargain sheet" of the Gregory Electric Company, Chicago, Ill., contains a list of the largest stock ever carried by this company, including generators, motors, transformers, meters, arc lamps, instruments and repair parts. This stock is ready for immediate delivery. The company will be pleased to send a copy of the "bargain sheet" to any address upon request.

GOODWIN & KINTZ COMPANY, Station C, Winsted, Conn., announces that its new catalogue No. 31 is now ready. The catalogue contains 88 pages and is the largest and best of its kind. It shows about 250 different types of fixtures. This company is now making its own art glass shades, and the manufacture of dining-room domes is a new departure with it. Several of these are shown in the new catalogue.

PREPAYMENT WATT-HOUR METERS.—Flyer No. 4083 of the Westinghouse Electric & Manufacturing Company, which deals with prepayment watt-hour meters, contains valuable hints in the form of two tables showing for what length of time certain numbers of 16-cp lamps can be operated for 25 cents with energy at 10, 12.5 and 15 cents per kw-hour, and how long certain fan motors can be run for the same money with energy at the same rates.

THE CHICAGO FUSE WIRE & MANUFACTURING COMPANY has issued its catalogue No. 19, covering open and enclosed fuses of all the kinds which it manufactures. It begins with enclosed fuses and fuse blocks for the new National Electrical Code standard fuses, and then takes up enclosed fuses made to fit the various old style enclosed fuse

blocks which are still in use. The latter part of the catalogue is given to open-link fuses and fuse wires.

NOVI LAMPS.—Bulletin No. 2 of the Franklin Electric Manufacturing Company, Hartford, Conn., is a handsome specimen of the printing art. The cover design and particularly the illuminated initials would be creditable to a professed art publication. The text is devoted to a "preachment" in the interest of the Novi lamp, in which the prospective purchaser is taken energetically in hand and told plain truths in homely terms he cannot misunderstand.

STROMBERG-CARLSON TELEPHONE EXCHANGES.—The Stromberg-Carlson Telephone Manufacturing Company of Rochester N. Y., has issued a thirty-two page pamphlet entitled "Lost Time," describing various branch exchanges and equipments of its system. The cover is printed from a special design in four colors and bronze; the inside pages are printed in three colors, the illustrations being in two colors. Headings and initial letters are mostly of special design made for the publication.

DOUBLEDAY-HILL CATALOGUE.—The Doubleday-Hill Electric Company, 919 Liberty Street, Pittsburg, Pa., is sending out to the trade its new catalogue. It comprises seven hundred and twenty-five pages, 10x6½ inches, of a complete, comprehensive and up-to-date line of electrical material. All obsolete matter has been entirely eliminated, so that nothing but the latest and most approved material can be found. Apparatus from 100 to 5000 volts is illustrated; even the tantalum lamp is shown.

SMALL SINGLE-PHASE MOTORS.—Bulletin No. 3 of the Electric Supply Company, St. Louis, Mo., describes a line of small motors which has been designed to meet the demand for a small alternating motor which can be operated from single-phase lighting circuits, which will give the same service as direct current motor of equal capacity and which will require a minimum of attention and cause no disturbance of lamps in starting. The design is such that from no load to full load there is extremely small variation in speed.

COCHRANE HEATERS, with the title, "The Profitable Utilization of Exhaust Steam as Accomplished with Cochrane Heaters," the Harrison Safety Boiler Works, of Philadelphia, has issued a handsome octavo pamphlet of 112 pages which thoroughly considers the merits of open feed-water heaters in general, and of the Cocrane heater and oil separator in particular. The publication has more the character of a treatise on feed-water heating and purification than of the usual trade pamphlet, and as such will be found of interest and value to all steam users.

FLAME ARC LAMP.—The operating characteristics and advantageous features of metallic flame arc lamps are discussed in circular No. 1145 of the Westinghouse Electric & Mfg. Company. It is stated that the metallic oxide lamp using 4 amperes at from 65 to 70 volts has an illuminating effect superior to that of an enclosed carbon arc lamp using 6.6 amperes at from 75 to 80 volts. Moreover, the life of the metallic oxide electrodes exceeds that of the carbon electrodes of the enclosed arc lamp. A 12-in. electrode consisting of iron oxide in an iron tube has an average useful life exceeding 150 hours.

THE SPRAGUE ELECTRIC COMPANY, New York City, in its new bulletin, "Electric Power in the Printing and Allied Trades," has traced the remarkable progress made by it in equipping different kinds of printing machinery with Sprague motors. The list of printing establishments given as having been supplied covers a great number of concerns in domestic and foreign countries. This bulletin No. 229 contains 74 pages, 8 x 10½ inches, and is filled with information and suggestions invaluable to the progressive printer and those having to do with binding, electrotyping and stereotyping machinery.

PRICE LISTS.—The trade will be interested in the New Idea Catalogue of electric light and power supplies and net price list issued by the "Commercial" Electrical Supply Company, of St. Louis, Mo., the special features of which are as follows: It contains the 1907 Fire Prevention Bureau Rules. The price list is made up with light-faced type for factory shipment material and heavy-faced type for stock shipment material. On the front cover of the price list are two columns to indicate change in prices during the current month, one indicating goods advanced, and the other goods declined. It also contains complete information pertaining to conduit construction. This book will be sent upon request.

ELECTRICAL MEASURING INSTRUMENTS.—Catalogue No. 65 of the American Instrument Company, 1114 Chestnut Street, Philadelphia, Pa., in addition to describing various lines of switchboard and portable voltmeters and ammeters for direct-current circuits, contains an interesting discussion of the constructive details which render the instruments exceptionally accurate and reliable. One of the most valuable features of these instruments is found in the fact that the ammeters are provided with interchangeable shunts. Thus any shunt of any rating can be used with any pair of leads and any ammeter movement, and the readings will be correct.

LAGONDA VALVES.—Just what can happen when a steam main bursts or a fitting on the line breaks, or one boiler of a battery gives way, is vividly told in a newly issued pamphlet describing the Lagonda automatic boiler cut-off valve. The pamphlet also explains the dangers from ammonia explosions and the way in which the cut-off valve may be used to stop the flow before enough of the ammonia gets out to do any harm. A number of interesting tests are given to show the certainty with which this type of automatic valve does the work in case of accident. The valve is illustrated in detail and its action explained. This pamphlet may be had free by writing to the Lagonda Manufacturing Company, Springfield, Ohio.

WATSON-STILLMAN COMPANY, New York City, has issued an admirable catalogue on "Hydraulic Pumps" and accessories. It is in reality a selection from over 800 pages of its printed matter, and its sectional catalogue No. 71. It contains 140 illustrated pages, and emphasizes the special features of design and construction connected with its name. A special feature of the design is the placing of all valves above the cistern top, where they may be examined or repaired without displacing any other parts than the bonnets over each one. Provision is made for easily taking up lost motion, and in most of the pumps small parts are interchangeable. In pumps of small and medium sizes the tank or cistern acts as the stand or foundation. Attention is called to the fact that the pumps are built so that they do not trap air, which is the most annoying feature of hydraulic work.

"ELECTROLESS" is the name of a new pipe covering, in regard to which the H. W. Johns-Manville Company, 100 William street, New York City, has just issued a neat little folder. Electroless pipe covering is the direct outgrowth of the demand for a preventive of electrolysis in underground pipes. It is a sectional covering of a specially prepared asbestos paper in laminated form, thoroughly impregnated, and coated with a high grade water-proof insulating compound, which presents an effective barrier to the transmission of electric current. This covering acts as an insulating medium between the pipe and ground, and, being made of indestructible materials, is permanently durable and has a lasting efficiency. The covering is ¼ to ⅜ inch thick, and is furnished in 3 feet sections, to fit various sizes of iron and lead pipes. All longitudinal and abutting joints are securely sealed by means of strips and insulating cement, which are furnished with the covering. For sleeve couplings, etc., a special sleeve of Electroless pipe covering is provided.

DECAY OF POLES.—The Universal Pole & Post Preserving Company, of Circleville, Ohio, has issued a pamphlet on the "Decay of Poles," by Dr. Howard Jones. The method of the company under the patented process of Mr. H. P. Folsom is to remove the earth around the pole to a depth of about 16 inches. Then all the decayed wood is scraped or cut away with special tools and a hole is bored to the center of the pole to discover if the center is sound. If the center of the pole is hollow this is filled with a chemical in solution with water. An asbestos and asphalt jacket of special manufacture is then placed around the pole, leaving a space between the jacket and pole of about one inch. This space is filled with a composition of germicidal chemicals mixed with sand, and the top is sealed and a good finish is placed upon it with cement. The appliance is more indestructible than the pole, and together with the chemicals will protect the pole for a period of many years. The chemicals applied to the pole will kill the fungi and destroy the enzyme, and at the same time will harden the wood. Poles treated seven years ago show no infection at the present time. The jacket is so durable that, at the end of a given number of years, the contents can be freshened by the injection into the space between the jacket and pole occupied by the sand of a new supply of fungicide.

SINGLE PHASE INDUCTION MOTORS.—The general characteristics of small self-starting single phase induction motors are fully discussed in bulletin No. 3100 of the Emerson Electric Manufacturing Company, St. Louis, Mo. The motors described are started by the split phase method, the starting coils being disconnected automatically by centrifugal force when the speed has increased to a proper value. Bulletin No. 3111 deals with single-phase motors of .025 hp and .05 hp designed for starting without load. Bulletin No. 3112 describes a .05-hp single phase induction motor that starts from rest under full load torque. Motors rated at .10 hp and .125 hp with a full-load torque at starting and intended for intermittent serice are treated in bulletin No. 3113. A .17-hp motor capable of starting up with full-load torque is described in bulletin No. 3114. Light-load automatic-start motors rated at .125 hp and .17 hp are discussed in bulletin No. 3115, while those rated at the same value but intended for intermittent service are dealt with in bulletin No. 3116. Bulletin No. 3117 is devoted to .17-hp and .25-hp motors designed for starting under full load torque. Motors of the same type but rated at .25 hp and .33 hp are described in bulletin No. 3119. One-half hp motors of this type are described in bulletins No. 3120 and 3121. Bulletin No. 3118 deals with motors rated at .125 hp and .17 hp, designed for full-load automatic start and for intermittent service. Back-geared motors of .25 hp and .50 hp are described in bulletin No. 3122.

"ELECTRIC HEATING AND COOKING DEVICES FOR MARINE USE" is the title of a handsome publication just issued by the General Electric Company as Bulletin No. 4523. The pamphlet is bound in a neat cover and contains illustrated descriptions of small apparatus particularly useful in ships' galleys, staterooms, smoking rooms, sick bays, etc. A ship's lighting plant, usually of more than ample capacity for intermittent load, offers at once an available source of supply, which, utilized for cooking, heating, etc., would provide numerous real and profitable conveniences with small increase in cost. The electric heater on account of its compactness, neatness, easy regulation and simplicity is ideal for stateroom use. One or two quart water heaters, electric wash bowls and electric shaving mugs are familiar conveniences and electric flat irons in sizes from three to twenty-four pounds are supplied for the laundry. Among special devices particularly serviceable on shipboard may be mentioned electric soldering irons, glue pots, curling iron heaters, surgeon instrument sterilizers, heating pads, cigar lighters, etc. Two distinct forms of heating elements are used by the General Electric Company, known as the cartridge and quartz enamel units. Both heating units are practically infusible and indestructible but can be readily replaced if damaged by accident. The company has taken great care in the design to insure the most

Relatively small capacity-areas show equal efficiency in all planes of orientation about a vertical axis. Even in the case of capacity-areas whose length is great compared with the width only a slight decrease in efficiency is noticeable when the area is normal to the wave front. Open-circuited helixes are equally efficient in all planes of orientation. The energy received by such a helix having a given length of wire is a function of its dimensions. An aerial almost completely screened is but slightly less efficient than a similar unscreened system. In dealing with multiple-wired antennæ it is practically immaterial as to whether the component parts are connected at the lower, upper or both ends. In considering different types of receiving systems, the actual capacity is not so important as is the manner in which this capacity is distributed. Of the types tested, the system consisting of one or more wires normal to the earth's surface is by far the most efficient. Practically all of the energy is propagated through the surface of the earth and not by means of a free ether wave.—*Physical Review,* September.

Telegraphone.—E. HYTTEN.—An illustrated description of the latest commercial form of the Poulsen telegraphone for connections with telephones and for use in combination with the typewriter.—*Elek. Zeit.,* Sept. 5.

Railway Signals.—A. SOULIER.—An illustrated description of the electric signals on the Paris Metropolitan Railway. The Hall automatic block system which has been adopted there comprises two quite different types of installation: First, the track circuit system in which the control of the block apparatus is effected by the train axles short-circuiting the Hall relays, and, second, the pedal system in which the apparatus is controlled by a pedal worked by the wheels of the cars.—Lond. *Electrician,* Aug. 30.

Electricity, Gas and Telephones.—Abstracts of the report of the engineer to the City of London Corporation. He states that there has been a saving of $2450 in the cost of street lighting in the three areas where gas has displaced electric lighting. Mention is again made of the great inconvenience caused by the laying of telephone and electric lighting service wires, and the frequent and long-continued opening of the street boxes. In addition to laying 320 new service wires, the telephone manholes were opened on nearly 2000 occasions, exclusive of mere inspection. Overhead wires in the city continue to increase, there being now 731,500 spans crossing public thoroughfares, compared with 699,300 spans in 1906, and 260,000 spans in 1899 —Lond. *Elec. Eng'ing,* Aug. 29.

Concrete Poles.

The patents granted to Mr. William M. Bailey, of Richmond, Ind., on reinforced concrete poles have been assigned to The American Concrete Pole Company of Richmond, Ind., which will construct concrete poles under contract, and also sell the right to construct to other companies and users on a small royalty basis or sell the right of certain territory.

This type of concrete pole employs a reinforcement of twisted rods and spiral binding wires distributed in the column of cement and it is claimed that poles thus made are not only substantial and durable, but also possess remarkable elasticity. For instance, a pole 30 ft. in length will permit a deflection of 30 ins. before the cement cracks, corresponding to a horizontal strain at the top one-third greater than would be sufficient to destroy a cedar pole of the same dimensions. It is also claimed that cracking of the cement does not impair the strength of the pole, for after this takes place the reinforcement takes the entire strain, and the special rods will withstand a breaking strain of 50,000 lbs. per sq. in.

As will be seen by the accompanying illustrations, the poles are square with the corners beveled off two or three inches, thus making the top of the pole octagonal in shape. This not only gives a handsome appearance but leaves corners without a sharp edge that would be liable to chip off.

The four reinforcing rods are placed within three-quarters of an inch of the surface of the cement at the corners and then bound together by a spiral wire encircling the rods from top to bottom. This not only serves to tie the rods together but prevents danger of the cement shearing off, as the rods have a tendency outwards when the pole is subject to a lateral strain. Another important function performed by the spiral binding wire is that it ties the concrete together and increases the flexibility of the entire body.

The smaller poles, up to and including 35 ft. in length, are molded lying on the ground, and after they have been seasoned are set in place by means of a gin pole. The forms are laid with the butt near the hole and the reinforcement placed. Then the concrete is poured in and allowed to remain from three to seven days, according to the weather. The forms are then removed, so that they can be used again and the pole is left to season, which process requires about three or four weeks; the poles are then ready to be set and used. All poles

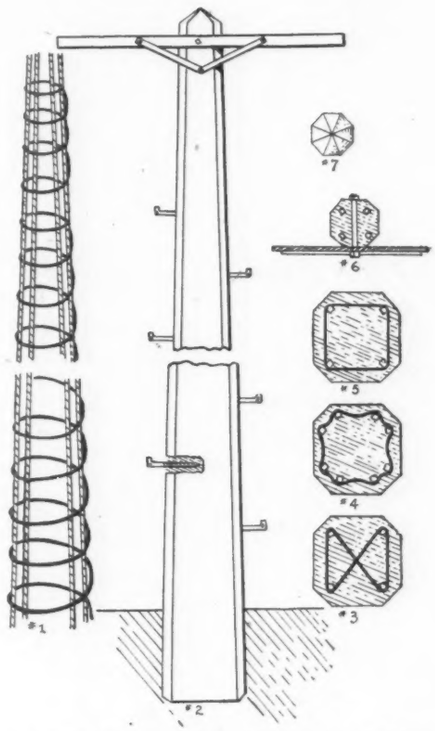


FIG. I.—DETAILS OF CONCRETE POLE CONSTRUCTION.

should be built on the ground upright in the hole or in position to be set up, thus saving the cost of hauling or unnecessary handling, as this would increase the cost.

Poles 40 ft. in length and larger should be built standing as this is the most economical method. First, the hole is dug and then the form is set in place directly over it, and lined up straight and perpendicular, being temporarily guyed to hold it in position. The spiral binding wires are then put in place and the rods drawn up on the inside of the form and set. After the reinforcement has been properly secured, the side of the form that has been left out to receive the steel work is put in place and the bands or ties around the outside secured. The equipment is then ready to receive the concrete.

There are several methods of placing the concrete. One is by using a large bucket with pulleys and a horse. With this method, a 50-ft. pole can be filled in about two hours, including the mixing of the concrete. But the most economical plan is to have a wagon equipped for the purpose with a gasoline engine concrete mixer and grain elevator. With this equipment the material can be placed as rapidly as it can be mixed. The American Concrete Pole Company is now building wagons for the handling of concrete and concrete poles.

It is claimed that every pole is a lightning rod and not only protects itself from being shattered by lightning, but is a safe-

guard to instruments and machinery at each end of the line, as the major portion of the lightning will be conducted to the ground through the steel reinforcement.

Fig. 3 shows a line of concrete poles constructed across Whitewater River, at Richmond, Ind. These poles are from 40 ft. to 60 ft. in length and were built in a perpendicular position. Fig. 2 shows a pole in detail two years old which has been subject to all kinds of strain. In Fig. 1 are given details of pole construction and reinforcement, as follows: No. 1 shows the four steel rods as they are placed in the cement body, with the spiral binding wires pulled in place; 2 shows the shape of cement body as finished; the steps and other bolts and holes

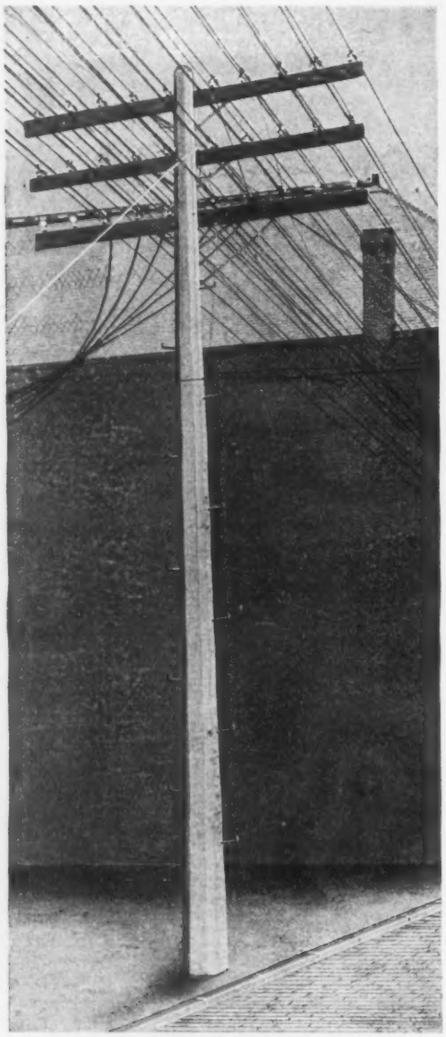


FIG. 2.—CONCRETE POLE.

are very easily made while the concrete is plastic; 3, 4 and 5 show cross-sections of a pole with three different methods of binding and also two different methods of reinforcing; the scheme represented in 4 is intended only for extremely heavy construction; 6 gives detail of the manner of securing cross-arms. A bolt or rod is placed in the form and removed within 24 hours after concrete has been in place; this leaves a clean hole through which the bolt that is intended to hold the cross-arm can be placed and the arm securely bolted on. Seven represents the top or roof of the pole, which is easily put on after the pole is finished, but is not necessary except for appearance.

Mr. Bailey has made applications for patents on forms varying in sections from 5 ft. to 15 ft. each and divided up so as to be easily handled. After the forms are assembled and put in place, the binding wires which have been previously wound in the proper shape and placed ready to receive the rods. After the rods have been drawn in, the binding wire is stretched from bottom to top, which gives a tie around the rods about every 4 ins. The rods are then spread and placed and, after the form has been secured, the concrete is

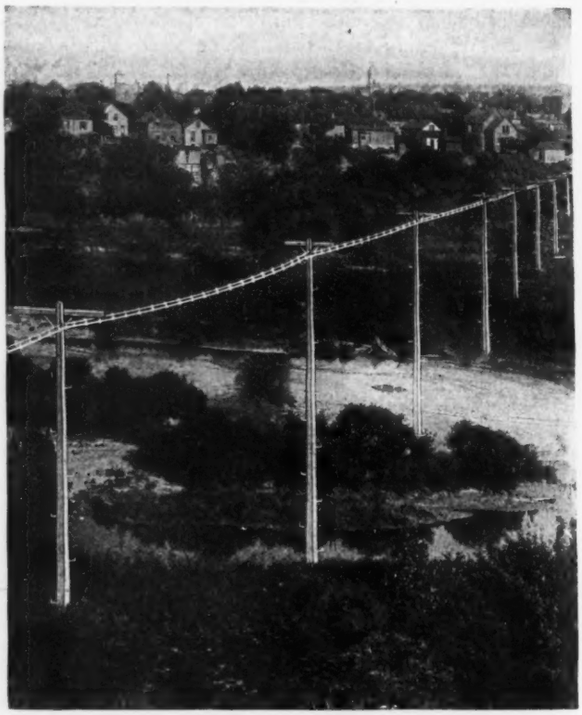


FIG. 3.—LINE OF CONCRETE POLES.

poured in and allowed to harden. After three or four days the forms can be removed and the pole left to be seasoned, and it will be ready for use in about three weeks.

Compact Panel-Board.

The accompanying illustrations indicate a panel-board in which the width has been reduced to the minimum. An appreciable reduction over standard practice has been obtained by raising the outer bus-bars and connecting them by bars to

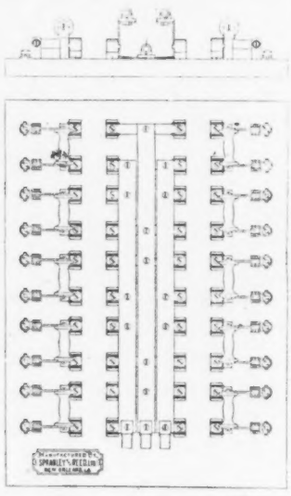


FIG. 1.—PANEL BOARD.

the positive and negative fuse clips, respectively; the outer bars are separated by only .75 in., which is the limit allowed by the Code. The neutral bus-bar is not elevated. By means of the triangular arrangement of the bus-bars, there is obtained a saving of 4 ins. over the usual linear arrangement. The result is a neat and compact panel. Although the regular type of

three-wire switch-panel now on the market ranges in width from 16 ins. to 18 ins., the panel here illustrated is only 12 ins. wide. The same width is used in two-wire bus-bar panels,

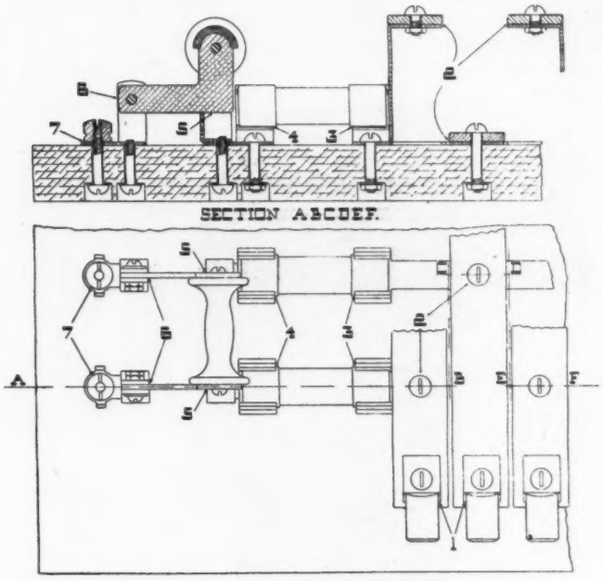


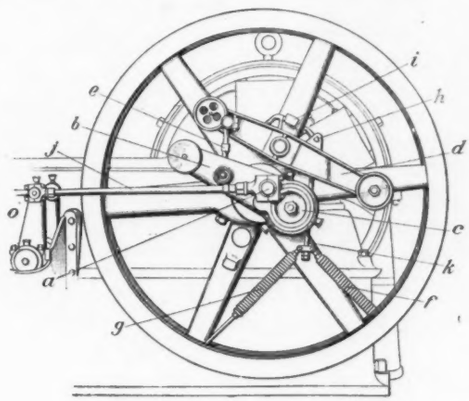
FIG. 2.—DETAILS OF THREE-WIRE PANEL.

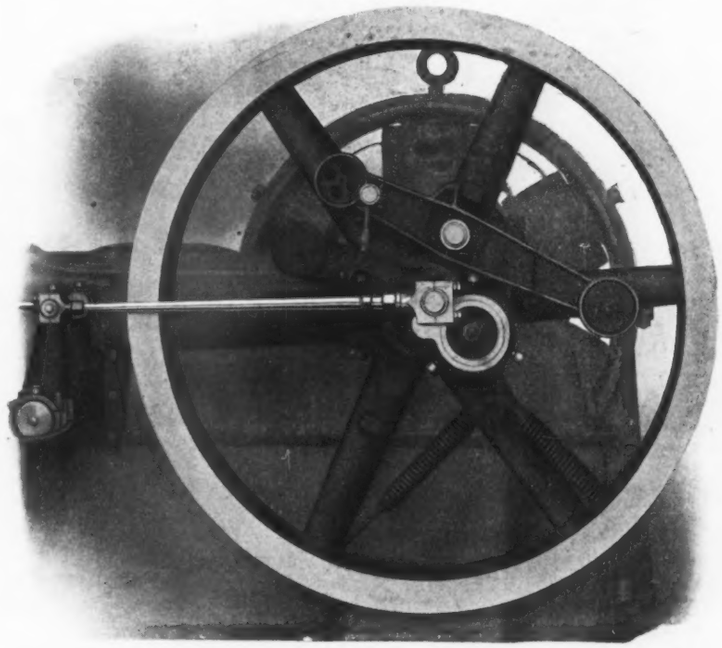
so that the same type and size of cabinet is employed for both two-wire and three-wire panels.

The panels here described have been placed on the market by Spranley & Reed, 61 Baronne Street, New Orleans, La.

A Balanced Automatic Governor.

The engine governor illustrated herewith has been developed as the result of an attempt to produce a governor that operates properly not only on the testing floor, but continuously after being placed in active service. The governor comprises the following parts designated by letters in Fig. 1: *A*, valve actuating stud; *B*, eccentric pin carrier; *C*, eccentric pin carrier bushing; *D*, governor weight; *E*, governor link; *F*, radial spring; *G*, tangential spring; *H*, knife edge; *I*, stop; *J*, ecentric rod, and *k*, governor eye-bolt. It will be noted from Figs. 1 and 2, that the center pivoted mass, or "ecentric pin carrier" as it is called, is shorter





FIGS. 1 AND 2.—AUTOMATIC GOVERNOR.

than in the earlier type of governor. It was found by experimentation that this extra mass could be dispensed with by slightly changing the proportions of the other members. The second apparent change is in the spring arrangement, where two springs, tangentially and radially arranged, are substituted for the single spring.

A two-weight system is employed to secure a governing effect, the rotative pull being the combined effect of angular inertia and centrifugal force, with the complete elimination of gravity forces as affecting in any way the behavior of the system. A centrifugal pull, varying with the speed, is produced by means of the eccentrically pivoted governor or weight arm, and secures gravity balance for the system by linking this outer arm with the concentrically pivoted eccentric pin carrier. The center of gravity of this member is so closely over the center of figure of the shaft that its swing produces practically no centrifugal force whatever, thereby avoiding the oscillations so disturbing in single-arm systems. This arrangement prevents any reciprocating swing, not only in the eccentric pin carrier, but also on the balanced governor or weight, and provides a very favorable condition for delicate action of the governor, which is especially adapted for the difficult regulation of heavily fluctuating loads.

A new feature of the present governor is the peculiar arrangement of the springs. Where a single spring is used the centrifugal force and gravity of the spring disturbs the functional balance of the system. As the wheel revolves more rapidly, the spring, bellying out under the action of the centrifugal force, has its tension increased, so that it over-restrains the weight arm and retards the decrease of travel of the slide valve necessary to prevent undue acceleration on the part of the engine.

By dividing the spring force into two springs acting at right angles to each other, one a tangent spring, the other radial, a resultant spring effect is obtained, acting in direct line with the governor eyebolt and knife edge. This arrangement completely suppresses swinging or pumping, and causes the spring arm and centrifugal arm to shorten together as the engine tends to speed up, maintaining a constant proportion between the two, hence a constant speed. At each stage of a revolution, the errors of swing and tension variation normally incident to one spring, are corrected by the other, maintaining a beautiful balance, which, apart from other advantages, very materially reduces the wear on the tool-steel knife edge.

If in testing the governor, the engine speed is found to fall off too much, the radial spring is made weaker; if the speed increases unduly, the tangential spring is made weaker than the radial spring. Thus, governing elements are secured which cannot get out of adjustment even after long usage, because wear is reduced to a minimum and the system's members are mutually corrective in their opposing tendencies.

Some months ago the American Engine Company, of Bound Brook, N. J., was granted very complete patent protection on the new self-contained governor, with which it now equips all of its engines. Experience and observation have shown that the governor will remain in adjustment for effective functioning for more than 18 months after setting, keeping the speed regulation well within one per cent under severe fluctuations of load.

Fault-Finder for Cable Installations.

In the fault-finder illustrated herewith there is used a variable slide resistor which enables resistance to be obtained in practically infinitesimal steps, and yet it is substantial in construction. By means of the equipment, four methods can be used for locating faults, these faults being either grounds or crosses between the wires. Generally these methods may be used in succession for the same fault, in order to eliminate errors. Instructions for making the many kinds of tests to which the apparatus is adapted are given in simply expressed

FAULT-FINDER.

language and clear diagrams. The directions show that by connecting a telephone and a small buzzer to the posts, the distance from the station to the point where the wire is broken may be ascertained with simplicity and accuracy.

The simplicity of the apparatus, together with the clearness and fullness of the directions for using it, make it adaptable for the immediate use of unschooled persons who work on cables. The fault-finder has recently been placed on the market by the Leeds & Northrup Company, Philadelphia, Pa.

New Portable Relay.

In addition to its well-known line of voltmeters and ammeters for both portable and switchboard work, the American Instrument Company, of Newark, N. J., has recently developed an exceedingly sensitive, yet rugged and reliable portable relay. These instruments are built on the same principle as the regular type of "American" voltmeter having a movable coil mounted in jewel bearings in such a way that it can turn between the poles of a powerful permanent magnet. Instead of the usual pointer, a short platinum contact arm is securely attached to the moving coil. On each side of this contact is mounted an adjustable platinum contact point, so that a local circuit may be closed when the moving arm is deflected to either one side or the other of its normal position. The instrument may be closely adjusted, so that, within reasonable limits, any desired movement of the contact arm can be provided for. The winding of the moving coil and the controlling spring are adapted to give the best results under special conditions.

At maximum sensitiveness this relay requires .000002 watt to actuate it, this being on .0000002 ampere and .001 volt potential

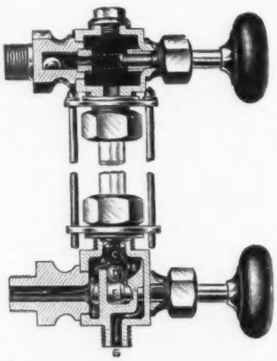
PORTABLE-RELAY.

difference. The resistance of the instrument usually supplied is approximately 500 ohms.

Special machinery has been designed for the manufacture of some of the parts of the instrument, which is suitably mounted in a polished wooden case as shown in the cut.

Automatic Water Gauge.

Herewith is illustrated the "Success" automatic water gauge, made by the Penberthy Injector Company, of Detroit, Mich. In the engraving, E is a double-seated valve to close both the gauge and the blow-off. It will be seen, therefore, that every time the lower handle is turned to blow-off the gauge the automatic device or ball D is moved by the stem on which it rests. In addition to this the stem follows the course of the arrows



SECTIONAL VIEW OF WATER GAUGE.

B to the outlet G, creating a downward pressure on the ball D and rolling it about in the chamber in which it is located. This great agitation of this ball from three to six times a day prevents it from ever becoming limed up and stuck fast. When the glass breaks, everything is reversed; the steam rushes upward to the break, creating a strong vacuum at the lower end of the glass, when ball D is instantaneously raised to the location marked C, when the flow of steam ceases. The upper ball is forced to its seat by pressure from the boiler. The double seats of the valve E can be ground by simply loosening the stuffing nut on the handle.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—A perceptibly better feeling in trade circles was noted, due to more favorable conditions in various lines. There was improvement in the general financial situation, more favorable weather for crop development, and less strain in the time-money market. Retail trade was hardly as brisk as was expected, because the warm, forcing weather, while helping crops, did not stimulate fall buying to any great extent. Reports as to jobbing trade so far this fall are, in the main, favorable, though the undertone of conservatism is still perceptible, and the feeling is that frequent, rather than large, buying is to be the keynote of the autumn trade. Collections, as a whole, are better. Railroad earnings are good and there are reports of increasing difficulty in obtaining cars to move coal, merchandise and crops. There was a better feeling in the iron trade, more inquiry manifesting itself, but quotations were no firmer for leading products. Iron for steel making was stronger, but basic pig was offered at lower prices in the Pittsburg district. The demand for heavy steel rails was light, and orders for structural material were in fair proportion. Manufacturers of hardware report conditions fairly satisfactory, but orders ahead are not up to those of previous years, although many factories are working on orders for future delivery. The same condition obtains in the manufacture of brass goods and gas fixtures. The outlook, on the whole, is not considered so entirely discouraging as in 1906, although in some instances manufacturers are crowded for delivery and have plenty of work ahead. The principal cause of complaint, however, is difficulty of collection, and this appears to be general throughout the metal trade. Copper was weaker, as low as 15¼ having been quoted for Lake during the week, while 15 to 15⅛ was the price named for electrolytic, with 14¾ to 15 for futures. At the lower levels business became a little more active, chiefly on account of foreign consumers. Not much of a demand is looked for from domestic consumers, it being reckoned that stocks of finished brass and copper goods are heavy. The closing quotations were 15¼ for Lake, 14⅞ for electrolytic and 14⅝ for casting. Copper wire prices have been reduced 4 cents per pound. *Bradstreet's* reports 179 business failures during the week ending Sept. 19, against 172 in the week previous and 171 in the corresponding week of last year.

POWER IN NEW MEXICO.—Mr. A. D. Colman, of Albuquerque, New Mexico, has arrived in New York with the object of financing the Forest Power Company, of Silver City, New Mexico. His New York address is 1608 Amsterdam Avenue. The officers of the company are E. L. Woods, president and general manager; W. S. Cox, vice-president; R. P. Barnes, secretary; J. W. Carter, treasurer. The initial plant to be erected is 1000 hp., and the company already has contracts for 600 hp. It has a contract also for taking over the New Mexico Light, Heat & Power Company. The Forest Power Company is a corporation organized under the laws of the Territory of New Mexico to develop and sell electrical energy for industrial purposes in the towns and mining camps of Grant County, New Mexico. The charter has been secured under the laws of the Territory of New Mexico. The company has secured a site for its camp about sixteen miles in a northerly direction from the town of Silver City and on the Gila Forest Reserve, and has a license from the Government of the United States permitting it to erect its plant, and maintain its rights of way across the public domain. The company is incorporated for $750,000; $300,000 of this stock is preferred 6 per cent cumulative and $450,000 is common stock.

NOBLE ELECTRIC STEEL PROCESS.—It is stated that the Noble Electric Steel Company, 1380 Sutter stret, San Francisco, has been incorporated with a capitalization of $1,000,000, for mining and smelting Shasta County iron ores. It is stated that $150,000 of the stock issued at par value of $10 has been sold. The mines are located at Héroult on-the-Pit in Shasta County, where the feasibility of smelting Shasta County ore sand has been demonstrated to the satisfaction of those interested. The company has now on hand, according to the *Iron Age*, some 25 tons of pig iron, the product of its last run. The mine is being opened up and a surface track from the mine to the furnace, a distance of some 8000 ft., is in course of construction. Plans for an electric plant and for the manufacture of charcoal are well under way. Shipments of material for the completion of the plant are being held up until the Sacramento Valley & Eastern Railroad, now being built, reaches this point, which will probably be early in November. It is hoped that the new furnace will be in operation on a commercial scale in the spring. The officers of the company are as follows: H. H. Noble, president of the Northern California Power Company, president; C. B. Morgan, secretary.

PLANT FOR BLUE RAPIDS, KAN.—It is stated that within a short time incorporation papers will be taken out for the Blue Rapids Power, Light & Ice Company, with Jesse Axtell and Carson A. Axtell as the incorporators. The charter will provide for three lines of business: The installation of an electric power plant to furnish current for electric motors; the operation of an electric light system, and the installation of an ice plant. The promoters intend to put in their power plant just as soon as they can work out the details and secure the necessary machinery. The incorporators own the Anderson power lot with 100 horse-power and have purchased lots carrying an allotment of 275 horse-power with privilege of using the same through any wheel pit on the river. They intend to build their power plant on the Anderson lot, where they already have a foundation, and they will put the generator above high-water mark. They are intending to put in a generator of 200 horse-power capacity to start with. Quite a little power has already been spoken for.

THE HILLES & JONES COMPANY, Wilmington, Del., has taken steps toward the electrification of its entire works, in anticipation of the equipment with electric motors of the new machine shops recently completed. The motors selected as best suited for the purpose are of Allis-Chalmers Company's make and comprise the following machines, all being of the new type "K" for direct current and all shunt wound. A 140-hp motor to operate at 300 r. p. m., three 30-hp machines to operate at 575 r. p. m., two 15-hp motors with a speed of 425 r. p. m., three 10-hp to operate at 475 r. p. m., and one 10-hp for 475-900 r. p. m. When the entire plant is ready for operation the Hilles & Jones Company will have an output of power punches, shears and bending rolls far beyond that obtained from the older plant.

THE JONES & LAUGHLIN STEEL COMPANY is a recent purchaser of additional heavy Allis-Chalmers electrical machines in the shape of two 1000-kw, 6600-volt generators wound for 25 cycles, three-phase, and designed to operate at 94 r. p. m. These units, together with a 600-kw, direct-current generator, 2400-volts and operating at 110 r. p. m., will be installed in the new Aliquippa Works, situated on the Ohio River several miles outside of the city of Pittsburg. A new 500-kw motor generator set, comprising a synchronous motor rated at 6600 volts, wound for three-phase, 25 cycles, and a 250-volt, direct-current generator is also being added to the structural shop to carry a portion of the steel mill load.

AUGUST FOREIGN TRADE.—The chief of the Bureau of Statistics in the Department of Commerce and Labor reports the foreign merchandise commerce of the United States for August and eight months ending August as follows:

	1907.	1906.	1905.
Imports	$125,792,156	$105,588,604	$95,831,158
Exports	127,625,508	129,454,760	117,668,115
Excess exports	$1,833,352	$23,866,156	$21,836,957
Eight months ending August:			
Imports	$1,001,803,305	$805,540,383	$770,285,198
Exports	1,196,625,415	1,098,994,662	966,567,559
Excess exports	$194,822,110	$253,454,279	$196,282,361

PLANT FOR NEW ZEALAND.—No-term tenders will be received by the corporation of Napier, New Zealand, for the installation and working of combined electric light, power, and tramways. Address the Town Clerk.

THE COPPER MARKET.—The "Copper Gossip" of the National Conduit & Cable Company says with regard to the present situation: "Wide fluctuations have marked the course of the copper market lately, and the downward tendency of values has induced buyers to wait for settled conditions before placing heavy orders. The world's demand for copper has undergone a large and rapid contraction since Jan. 1, and on that account the market has declined sharply within the past 30 days. From July 1 to Sept 7 electrolytic wire bars have receded from 25¼ to 18 cents, and since the latter date there has been a further loss of 1½ to 2 cents per pound. Prices now quoted are 16½ asked. This reactionary course in prices has been the direct outcome of a heavy falling off in consumption and a high money market, and these factors have exerted their power in all their concentrated force upon the copper market. As a result of present conditions the total buying power for the last six weeks has proved utterly inadequate to sustain the semblance of stability, and prices have come down to the level of those of two years ago. The effect of recent developments and the striking events which have thrust themselves into the foreground are producing their legitimate result in the curtailment of business and the withholding of orders until the copper market gives unmistakable evidence of being on a firm foundation. Consumers of copper naturally have been conservative for some time past, and wisely so, but they will welcome the return to stability again by which they can secure a much bigger volume of business than is possible in the present unsettlement and uncertainty. It is becoming more and more evident that capital must be in more plentiful supply before the industrial interests of the country will be put to work on the extensions and improvements now held in abeyance until the monetary stringency is relieved. The present slowing down in business should have the tendency of diverting capital into other channels where it will be satisfied with more moderate returns on money invested in solid properties rather than in those more hazardous enterprises which dazzle the investor with short-lived earnings of abnormal size. When money is in sufficient supply at fair rates it will be surprising if there is not a big expansion in business all along the line. Improvement in the financial world would no doubt revive activity in electrical circles, where plans have had to lie dormant until the task of financing them successfully could be accomplished. On account of the suspension of much important electrical work, the demand for wire has fallen off greatly, and the copper market cannot expect to reach a permanently strong position before the wire users are ready to place large orders. With the underconsumption of wire and other finished metal goods there has been the simultaneous over-production of copper. The consequence of all this is that there is now a heavy accumulation of copper, which furnishes a strong argument in favor of the exercise of a most judicious conservatism among consumers. It will be necessary to work up the enormous floating supply before the copper situation will be in an absolutely sound condition. Curtailment of output or a shut-down of certain important mines is talked of, and it would seem as if the actual position called for some heroic remedy to prevent further demoralization. The situation will eventually cure itself and we will again see active times in copper, but meanwhile the safest course to pursue is that of the utmost conservatism carried out on a strictly cash basis. It is no time to take rash ventures or run big risks."

SOUTHERN PACIFIC TROLLEYS.—It is announced from San Francisco that the Southern Pacific Railway Company has awarded a $900,000 contract for the erection of a power house at Fruitvale. The power house will be the central station for Oakland, Berkeley, Alameda and Fruitvale lines, and the expenditures for overhead work and for sub-stations will bring the total cost up to $2,000,000. The contracts were let in New York by Mr. A. H. Babcock, electrical engineer for the road. As the Southern Pacific does the largest suburban business of any railroad in the world, the enterprise of electrifying its suburban line south of San Francisco is being watched with great interest. The cars will be run in solid trains with a motor car at each end of the train, the electrical energy being delivered by overhead trolley. Each car will have a seating capacity of 80 persons. It is stated that the necessity for electrification came with the great increase in suburban traffic, which crept up from 1,000,000 to 2,000,000 a month after the San Francisco fire. Three new ferry steamers are being built to accommodate this travel. Since the ferry system was established 300,000,000 passengers have crossed the bay on them.

WASHINGTON UNION DEPOT.—A special despatch from Washington says: "Plans developed for lighting the new Union passenger station and terminals in Washington, D. C., contemplate the use of 480 500-watt arc lamps, 500 high efficiency lamps and about 3600 16-cp incandescent lamps. To light the pipe and wire tunnels betwen the power plant and the station and express building requires 190 incandescent lamps, or one every 10 ft. To care for the wires used in this great lighting system required the installation of about 88,000 ft. of conduit of various sizes in the station and about 68,000 ft. in the express building, power plant and K street signal tower and about 12,000 ft. in the train sheds. In addition to the lighting conduits, about 20,000 ft. of conduits are required for the telegraph and telephone wires at the station and about 12,000 ft. at the express building, power house and K street signal tower. Owing to the unusual size and height of the ceilings and some of the rooms in the station, special lighting schemes were resorted to. Natural light is provided by the use of semi-circular windows located at about the elevation of the spring line of the ceiling arch."

THE GRAPHIC ARTS COMPANY, Buffalo, N. Y. recently purchased a new Allis-Chalmers 45-kw type "K" generator with a complement of seven 5-hp type "K" direct-current shunt motors built by the same company for operation at a speed of 1050 r. p. m. and two 3-hp type "K" motors for operation at 1025 r. p. m. Five of the 5-hp motors are for belting to presses and the equipment is to be so arranged as to secure a speed range of from 1200 to 1500 impressions per hour. One 5-hp motor belted to a paper cutter, another to a roughing machine, while a 3-hp machine will be mounted on the bronzing machine.

CHILEAN POWER.—United States Consul A. A. Winslow, of Valparaiso, reports that the German Transatlantic Electric Company has a concession to erect a hydraulic electric power and lighting plant on the River Maipo, above Santiago, at an estimated cost of $4,015,000 United States gold, of which about $1,295,040 will be for materials and machinery that must be imported. It is estimated that it will take about five years to complete the undertaking. The company has petitioned the government of Chile for the free entry of their machinery and material for a period of five years.

STANLEY WORKS.—Beckwith & Pike have been awarded the contract for the erection of the new annealing building for the Stanley Electric Manufacturing Company, Pittsfield, Mass. The building, which is to be known as No. 7, will be of brick and steel construction, will be located north of the main shops. It will be 120 ft. by 120 ft., two stories high, and is to cost about $30,000. This will probably be the last building erected by the company this year.

PLANT FOR EGYPT.—Tenders will be received until November 1st by the Egyptian Government for an electric installation for the port of Alexandria, comprising five large and seven small transporters, six 4-ton cranes, thirty-six 2-ton cranes and twenty-five capstans; also cables, accessories, construction and installation of central power station. Address Directeur des Ports et Phares, Alexandria, Egypt.

HILL-WRIGHT ELECTRIC.—Mr. T. Wesley Wright, selling agent of the Hill-Wright Electric Company, of 105-107 Reade street, New York City, states that the company proposes to have an equipment ready by Jan. 1 to turn out 2500 lamps a day. The company will continue its "renewal" business, the new lamp department being a separate feature, but the principal part.

BOSTON EDISON GROWTH.—The Boston Edison Company reports for 1907 in the various cities and districts that it supplies 20,375 customers, as compared with 18,963 in 1906. Outside of Boston in the suburban districts the company has a 16-cp equivalent installed of 155,865 units, as compared with 133,758 last year.

AMERICAN BRIDGE COMPANY.—According to Pittsburg advices, the American Bridge Company in August broke all records for work completed, finishing 59,000 tons of fabricated steel. This is said to be 1500 tons higher than the record of any structural plant in the world.

THE CATTARAUGUS CUTLERY COMPANY, Little Valley, N. Y., has recently purchased extensive new machinery equipment for an addition to the present capacity of its two factories in Little Valley. The new machines comprise Allis-Chalmers engine, generator and motors. The engine is an 18-in. x 42-in. horizontal heavy duty Reliance Corliss engine belted to a 150-kw Allis-Chalmers alternator, wound for 60

cycles, three-phase, current 440 volt. The motor equipment includes three 40-hp Allis-Chalmers standard induction motors designed for a speed of 850 r. p. m., a 30-hp motor for the same speed, and three 5-hp machines for 1130 r. p. m. each.

ALLIS-CHALMERS COMPANY has been doing an enormous business the past year, and its inventory of work and tools and material passing through the shops has increased in proportion, so that like other great industrial concerns it has had to have more capital for handling its orders. The last four months in particular have seen an extraordinary expansion of production and contracts. The financial aid necessary has been freely forthcoming, chiefly, it is understood, from the influential steel interests prominent in the concern, and to cope better with the production necessities, a change is being made in the executive personnel, so as to secure the undivided attention of a first-class man. This ability has been secured in the selection of Mr. W. B. Kelley, the energetic president of the American Steel Foundry Company, who is to become chairman of the executive committee, and who will move to Milwaukee in order to deal with the problems right on the spot. Judge Gary will remain chairman of the finance committee, and with Mr. E. D. Adams will continue a director of the company. These gentlemen, have thus reinforced their own consummate financial and business ability with that of a man whose reputation has already been made in kindred fields, and whose own career is a pledge of high efficiency and success. It is predicted that in a very short time Mr. Kelley will have made a mark in his new chairmanship and put this great industrial organization where it belongs by reason of its history, its resources and its command of a vast field of consumption.

Financial Intelligence.

THE WEEK IN WALL STREET.—There was more or less irregularity in the movement of stock prices, yet the tendency, so far as the prominent railroad issues were concerned, was in the direction of improvement. The chief feature of the week was the activity of the Hill stocks under the lead of Northern Pacific. Reading also developed strength on the publication of the favorable annual report. The publication of Chairman Gary's conservative, though reassuring, interview regarding steel trade conditions and the position of the United States Steel Corporation was followed by a moderate recovery in the steel issues.

NEW YORK.

	Sept. 17	Sept. 24		Sept. 17	Sept. 24
Allis-Chalmers Co.....	6¾	8¾	General Electric 123		124
Allis-Chalmers Co. pfd. 18		23¾	Hudson River Tel.....	—	—
Am. Dist. Tel.....	—	20	Interborough Met. com.	9	9¼
American Locomotive..	51¾	52½	Interborough Met pfd..	25½	25½
Amer. Locomotive pfd..101		102¼	Mackay Cos.	63	63⅜
American Tel. & Cable. 75		75	Mackay Cos. pfd.....	62½	63½
American Tel & Tel...105		105	Marconi Tel.	—	—
Brooklyn Rapid Transit.	45¼	46¾	Metropolitan St. Ry....	41	—
Electric Boat	33	—	N. Y. & N. J. Tel.....	—	—
Electric Boat pfd.....	80	—	Western Union Tel....	77	75
Electric Vehicle	—	—	Westinghouse com.....*136⅛		130
Electric Vehicle pfd....	—	—	Westinghouse pfd.....	—	165*

BOSTON.

	Sept. 17	Sept. 24		Sept. 17	Sept. 24
American Tel. & Tel...106½		107¾	Mass. Elec. Ry. pfd....	49⅞	49⅞
Cumberland Telephone..102½		—	Mexican Telephone.....	2	—
Edison Elec. Illum.....	—	—	New England Telep....108		—
General Electric	—	—	Western Tel. & Tel....	5½	—
Mass. Elec. Ry.....	13	—	West. Tel. & Tel. pfd..	67	—

PHILADELPHIA.

	Sept. 17	Sept. 24		Sept. 17	Sept. 24
American Railways.....	46½	46½	Phila. Electric	7⅝	7½
Elec. Co. of America...	8⅞	9	Phila. Rapid Transit...	19¼	20¼
Elec. Storage Battery..	45	46¼	Phila. Traction	88	—
Elec. Stor. Battery pfd.	—	—			

CHICAGO.

	Sept. 17	Sept. 24		Sept. 17	Sept. 24
Chicago City Ry.....	—	150	National Carbon	—	—
Chicago Edison	—	140	National Carbon pfd...	—	117
Chicago Subway	—	18¾	Union Traction	—	—
Chicago Tel. Co.....	—	—	Union Traction pfd....	—	—
Metropolitan Elec. com.	—	20*			

*Asked.

The copper stocks continued weak, Amalgamated selling down to 58 and rallying to 62, after which it continued to be very variable, which was also true of Anaconda, American Smelting and others of the same class. The traction securities were comparatively neglected, and the minor industrials simply followed the course of the leaders without developing any special activity. General Electric closed at the highest point of the week, 128, which is a net gain of 2¾ points and Allis-Chalmers, both common and preferred, also closed at advanced quotations. On the curb market Allis-Chalmers bonds and Steel Foundry bonds were dull and weak. Copper stocks were inactive, with little change in prices. New York City's new 4½ per cent bonds advanced steadily and attained new highest records, and noteworthy gains were made by several important industrials. The closing quotations of Sept. 24 are given in the accompanying table.

DIVIDENDS.—The Memphis Street Railway Company has declared its regular quarterly dividend of 1¾ per cent on the preferred stock. The Knoxville, Tenn., Railway & Light Company has declared its regular quartely dividend of 1½ per cent on the preferred and 1 per cent on the common, payable Sept. 30. The Hudson River Telephone Company has declared its regular quarterly dividend of 1 per cent, payable Oct. 15. The directors of the Duluth Edison Electric Company have declared the regular quarterly dividend of 1½ per cent on its preferred stock, payable Oct. 1. The Chicago Telephone Company has declared its regular quarterly dividend of 2½ per cent, payable Sept. 30. The United Railways Company of St. Louis have declared the regular quarterly dividend of 1¼ per cent on the preferred, payable Oct. 10. The American Cities Railway & Light Company have declared a quarterly dividend of 1½ per cent on the preferred, payable Oct. 1. The Havana Electric Railway Company has declared the regular quarterly dividend of 1½ per cent on the preferred stock payable Oct. 15. The Tri-City Railway & Light Company has declared the regular quarterly dividend of 1½ per cent on the preferred stock, payable Oct. 1. The Aurora, Chicago & Elgin Railway has declared its regular quarterly dividend of 1¼ per cent on the preferred stock and the first dividend of ¾ per cent on the common. The Bell Telephone Company of Philadelphia has declared a regular quarterly dividend of 1½ per cent, payable Oct. 15. The American Telephone & Telegraph Company has declared its regular quarterly dividend of $2 per share, payable Oct. 15. The International Nickel Company has declared a dividend of 1½ per cent, payable Oct. 10.

GENERAL ELECTRIC BUSINESS.—Advices from Boston financial circles say as to electrical manufacturing: "So far as the General Electric Company is concerned the facts are these: There has been a little let-up in the volume of new orders coming in, but this decrease is nowhere nearly so great as is generally supposed and has so far been chiefly confined to railway apparatus such as motors, controllers, etc. From Jan. 31 to Sept. 14 the gross orders of the General Electric Company were $5,700,000 in excess of the corresponding period of 1906. Up to the middle of June gross business showed a gain of $5,200,000 over the same period of last year. In the last two months, therefore, gross earnings have not only held their own with the same months of 1906, but show an actual gain of $500,000. It will be noted, however, that the increase is only 10 per cent of what it was the first four and one-half months of the fiscal year, which began Feb. 1. This is the real gist of the let-up in business. Gross orders have to date not shown a dropping off as compared with last year, but they have failed to show the same ratio of increase that was recorded in the first four or five months of the current fiscal year. The General Electric Company has from time to time let some of its employees go. At present there are upwards of 25,000 employees carried on its books. This is a decrease of about 3000 from the 28,000 employees which the company was employing at the close of the last fiscal year."

NEW YORK CITY RAILWAY RECEIVERS.—In course with anticipated action, and by means of a petition alleging the insolvency of the New York City Railway and a confession of the charge on the part of that company, the surface lines in Manhattan comprising the Metropolitan Street Railway system, went into the hands of receivers this week. The application was made before Judge Lacombe, in the United States Circuit Court, Sept. 24, by the Pennsylvania Steel Company and the Degnon Contracting Company, creditors, and was in the form of a bill in equity, asking that the court take charge of the affairs of the New York City Railway and by the appointment of receivers provide for the liquidation of the company's indebtedness without its corporate disintegration. It was a "friendly" application, with Paul D. Cravath and De Lancy Nicoll of counsel for the traction interests, and James Byrne of the petitioners' counsel present and in entire harmony. Adrian H. Joline and Douglas Robinson, were appointed receivers, and they immediately qualified in the sum of $250,000 each, the bonds being furnished by the National Surety Company.

TOLEDO SECURITIES.—Application has been made to list on the New York Stock Exchange $1,875,000 additional capital stock of the Toledo, Ohio, Railways & Light Company.

BELL TELEPHONE GROWTH.—At the regular monthly meeting of the directors of the American Telephone & Telegraph Company the following statement of net earnings for the nine months to end September 30 was read:

	1907.	1906.	Increase.
Balance for dividends.....	$10,960,000	$9,575,000	$1,385,000
Dividends	7,893,000	7,564,000	329,000
Surplus	$3,067,000	$2,011,000	$1,056,000

The figures for the nine months this year are partly estimated, but they have been conservatively figured and will probably exceed the balance for dividends of $10,960,000, shown above. On the basis of the present amount of stock outstanding these net earnings compare as follows:

	1907.	1906.
Balance for dividends.....	$10,960,000	$9,575,000
Capital stock outstanding	142,514,000	131,551,400
Percentage on stock.....	7.69	7.27

In June the company offered to stockholders $21,925,200 new stock at par, half of which was payable on July 25 and the balance Oct. 25. The present outstanding stock, without making allowance for the few slight payments in full, which were made on July 25, may be figured at $142,514,000. To base share earnings on this capitalization is a little less than strictly just to the company, inasmuch as net earnnigs for seven out of the nine months were actually made on the capital stock outstanding Dec. 31 last. It is figured that when the company has received the full benefit of the recent abolition of night-rate long-distance calls there will be realized an addition of nearly $500,000 yearly to net earnings. It would not be at all surprising if final net earnings for dividends this year came close to $15,000,000.

PACIFIC GAS AND ELECTRIC.—The assessment of $10 a share on the stock of the Pacific Gas & Electric Company of San Francisco, which became delinquent on Aug. 31, has resulted in an unusual transaction in the securities of that company. The entire issue of common stock, amounting to $20,000,000, has been turned back into the treasury of the company, while the assessment on the preferred stock has been paid in full in cash, amounting to a total increase in the resources of the company of $1,000,000. The issue of $20,000,000 of the common stock had been held by the banking firm of N. W. Halsey & Company. The entire transaction was completed on Aug. 31, at which time $1,000,000 in cash was paid in by the shareholders of the preferred stock, of which John Martin and Eugene de Sabla are large owners. This fund will be used to pay for restoration work and extensions of the service made necessary in the last sixteen months. Instead of paying the assessment on the common stock the holders turned it back to the company, thus adding, it is claimed, more to the ultimate resources and financial soundness of the corporation than if the assessment had been paid, and the stock disposed of in the Eastern markets, as was the original intention. It remains a matter of curiosity in San Francisco financial circles to see what the corporation will do with the common, which is now virtually treasury stock. There have been persistent rumors of a purchase of a controlling interest in the Pacific Gas & Electric by the Goulds in connection with the electric power plans of the Western Pacific, and it is rumored that the Western Power Company may purchase the stock which has been returned to the treasury.

MASSACHUSETTS ELECTRIC.—Note is made in Boston of the fact that all through the depression of the local market there has been persistent buying of Massachusetts Electric common stock at $12.50 per share by several houses, and private bids for good-sized blocks of the stock are reported. In some quarters it is thought possible that the New Haven Railroad, appreciating that the management of the Massachusetts Electric Companies has expended $13,000,000 in placing the properties in excellent condition, is endeavoring to add them to its present extensive trolley system. The 900 miles of street railway of the Massachusetts Electric system (90 per cent of which has within the past few years been reconstructed) would prove a valuable addition, especially at the present market value, for the stocks are selling for about one-half their cost. There are now slightly in excess of 190,000 shares of subsidiary company stocks in the treasury of the Massachusetts Electric Companies, and these stocks will all show divisible earnings this year of about 5 per cent. The Boston & Northern will probably declare a 5 per cent dividend, while the Old Colony Company will declare a dividend of 4 per cent, as against 2 per cent last year. These declarations will give the Massachusetts Electric Companies an additional $800,000 for its treasury. The Massachusetts Electric preferred stock will not receive any cash dividend disbursement this fall, but when the bond market improves sufficiently to permit the sale of some underlying bonds it is planned to take steps to pay off the accumulated dividends, which amount to 14 per cent up to Jan. 1, probably in stock.

BELL TELEPHONE CONSOLIDATION.—From Washington come advices of the consolidation of the Bell Telephone Company of Philadelphia, the Pennsylvania Telephone Company and the Chesapeake & Potomac Telephone Company, all licensees of the American Bell Telephone Company, operating in Southern New Jersey, Eastern Pennsylvania, Delaware, Maryland, the District of Columbia, Northern Virginia and West Virginia. The companies involved operate more than 300,000 telephones. The purpose of the consolidation is greater economy and efficiency in administration and operation and greater facility in financing future extensions and enlargements. The authorized capital stock of the new company will be $60,000,000, which is less than the combined capital and outstanding indebtedness of the old companies. The capital stock provided for is sufficient, it is stated, to retire all of the old stock, discharge the floating indebtedness of all the companies and provide for several years' growth. The shareholders of the Philadelphia and Pennsylvania companies will receive an equal amount of the new stock for the stock surrendered, while the shareholders of the Chesapeake & Potomac Company will receive two shares of the new stock for three shares of the old stock. Mr. U. N. Bethell has for some time past been the inspiring and controlling spirit of this vast organization.

WESTINGHOUSE NOTES.—The Westinghouse Electric & Manufacturing Company has sold an issue of 20,000,000 francs in collateral trust notes in Paris. Application was made last week to list the notes, which run five years and bear interest at the rate of 5 per cent, on the Pittsburg Stock Exchange. An official of the Westinghouse Electric & Manufacturing Company, in explanation of the transaction, said it related to the business of the Société Electrique Westinghouse de Russie, organized for the purpose of executing a contract of over $5,000,000 with the municipal authorities for the St. Petersburg tramways. It is also for the purchase of electrical works in Moscow for the manufacture of machinery needed in the execution of the contract. These securities are to be offered by the Société Générale for subscription in France and other European countries, but not in America. The listing of the securities at Pittsburg is one of the formalities necessary in connection with the listing of the notes on the Paris Bourse. The sale of the entire issue provides the working capital for the business of the Russian Westinghouse Electric Company and 7,000,000 francs additional working capital for the French Westinghouse Company.

LAKE SUPERIOR CORPORATION.—The directors of the Lake Superior Corporation, the successors of the Consolidated Lake Superior Corporation, which three years ago passed through many financial vicissitudes, have decided not to make any payment this year on the $3,000,000 issue of income 5 per cent bonds, which were put out at the time of the reorganization of the old company. This decision was not the result of earnings, for these have been good, but was due to the desire to use all of the company's funds in its business. Earnings this year are nearly, if not altogether, as large as those of last year. At the same time, as the company is borrowing money for the conduct of its business, the directors thought it to the best interests of the stockholders, as well as of the income bondholders, not to make any distribution at this time. The company was handicapped during the year by the destruction by fire of its pumping station and by the necessity of blowing out two of its furnaces for the purpose of relining them. The loss by fire was fully covered by insurance, but the destruction of the pumping station nevertheless served to reduce the company's earnings.

OHIO TRACTION & LIGHT.—The Northern Ohio Traction & Light Company has issued a circular to stockholders offering them the right to subscribe for $1,000,000 treasury stock at $20 a share, payable 25 per cent on each Sept. 20, Oct. 20, Nov. 20, and Dec. 20, the proceeds to be used for improvements. An underwriting syndicate has been formed to take whatever part of the issue may be left after the stockholders' subscription.

CHICAGO EDISON MERGER.—At a meeting on Sept. 16 the Chicago Edison stockholders voted unanimously for consolidation with the Commonwealth Electric Company. Edison stockholders receive $160 in new stock for each $100 of present holdings and 60 per cent additional in trust certificates for capital stock of the Commonwealth Edison Company.

GENERAL NEWS

Construction News.

BRUNDIDGE, ALA.—This city will soon have a complete and up-to-date electric light plant and water works system. The electric plant has been completed and was put into operation for the first time Sept. 9. The two plants cost the city about $20,000.

HUNTSVILLE, ALA.—Francis N. Lawton, general manager of the Huntsville Railway, Light & Power Company, has announced that plans have been drawn for doubling the capacity of the power house and for extension of the street railway system.

ASHDOWN, ARK.—T. C. Ambrey, of Verda, La., is reported interested in the construction of a lighting plant.

DUNSMUIR, CAL.—The Southern Pacific Railway Company is preparing to install an electric light power plant to operate its shops at Dunsmuir. The work will consist of the construction of a dam, pipe line and the installation of water wheel and generators. No power house will be erected as the generators will be placed in the railway shops. The plant will have a capacity of 300 horse-power and will cost about $20,000.

LIVERMORE, CAL.—The Stanislaus Electric Company will soon commence the construction of its transmission line through this valley.

LOS ANGELES, CAL.—Plans have been made by the Los Angeles Railway for the immediate construction of several extensions of its lines in Los Angeles.

REDLANDS, CAL.—The stockholders of the Southwestern Home Telephone Company have authorized the creation of a bonded indebtedness of $1,000,000. Of this, $100,000 is to be used to pay floating indebtedness of the company, and the remainder to be used for further extension and improvements.

SAN BERNARDINO, CAL.—F. A. Worthley, of Riverside, has purchased the controlling interest of the Lytle Creek Power Company of this city. It is said that extensions are to be inaugurated at once.

SONORA, CAL.—Preliminary surveys are being made east of Bridgeport for the site of the power plant to be erected by the California-Nevada Electric Power Company, and also for the Nevada Mines Company, which will supply the Tonapah and Goldfield country with electricity for light and power.

STOCKTON, CAL.—The new steam plant of the American River Electric Company on Banner Island, in this city, is nearly completed and will soon be put into operation. The plant has a capacity of 3000 horse-power and will be used in connection with the company's large plant on the American River.

STOCKTON, CAL.—The plant of the Standard Electric Company at Electra was badly damaged recently by a bucket breaking loose from one of the large water wheels. The foundation of part of the building and a large generator were destroyed. Only part of the plant can be operated, and it has been necessary for the company to place its auxiliary steam plant in the city in operation. It is estimated that the loss will be more than $250,000.

YREKA, CAL.—The Gold Ball Mining Company has commenced work on the construction of its transmission line, which will furnish electricity for both the Gold Ball and King Solomon mines, also to other mines in this vicinity. The company has purchased the large ditch and flume formerly owned by the Salmon River Hydraulic Mining Company.

DILLON, COL.—The Summit Power Company has placed contracts for $500,000 worth of machinery and supplies, is laying pipe lines, and will soon commence the construction of a power plant in Dillon. The company contemplates an expenditure of $1,000,000 or more in Summit County.

LAS ANIMAS, COL.—Proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Nov. 9 for the construction of a power plant, building and machinery at U. S. Naval Hospital, New Fort Lyon, Col. Plans and specifications may be obtained at the bureau or from the medical officer in command of the hospital, Las Animas. Col. William M. Smith is acting chief of bureau.

MONTEZUMA, COL.—The Montezuma Mines Development Company has secured water rights on the Snake River and proposes in the spring to construct a power plant to furnish electricity for lighting and power for the mines in the district.

DANIELSON, CONN.—The New York, New Haven & Hartford Railroad Company has appropriated $40,000 for improvements to the Dyer Dam electric plant, about one mile south of this village. It is proposed to take out the two 400-kw generators now in the plant and install new ones of more modern type and to change the type of the motor power machines.

TERRYVILLE, CONN.—McCabe & Behler, the contractors who are excavating the tunnel through the mountain for the railroad, have decided to erect an electric light plant in order to complete the underground work. The plant will provide for at least 200 lamps of 32 cp.

WILMINGTON, DEL.—Plans are being made by the Philadelphia, Baltimore & Washington Railroad Company to install its own electric lighting system in the office building and the new elevated station. The company proposes to transmit electricity for the system from its shops at Todd's Cut. The present capacity of the plant consists of three dynamos of 200 kw. Another machine has been ordered and will be installed to provide for future needs. The Wilmington City Electric Company now supplies the railway company with electricity. George Woodward has charge of the work.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Oct. 1, to furnish at the navy yards and naval stations the following supplies: Boston, Mass., schedule 318—damp-proof wire, interior fittings, switches, steel enamel conduit fittings; schedule 319—copper rivets, copper wire, etc.; schedule 321—sheet brass, copper, rolled bronze; schedule 323—copper pipe, etc. New York, N. Y., schedule 291—engine lathes, boring mill, boring, drilling and milling machines; schedule 314—carbons, incandescent and arc lamps, electric wire, dry batteries, electrical supplies, etc. Naval Academy, Annapolis, Md., schedule 317—insulating tape, bells and buzzers, plugs, signal and deck lanterns, etc., glass tube fuses, switch handles, link fuses. Applications for proposals should designate the schedules desired by number. E. B. Rogers, Paymaster General, U. S. N.

PUNTA GORDA, FLA.—The citizens have voted to issue bonds for an electric lighting plant. The bonds have not yet been issued.

ASHBURN, GA.—An election will be called soon to vote on the proposition to issue $55,000 in bonds, of which $45,000 is to be used for the construction of an electric light plant and water works system.

MILLEN, GA.—The citizens have voted in favor of issuing $30,000 in bonds for the installation of an electric lighting system and water works.

WRIGHTSVILLE, GA.—The citizens have voted to issue $10,000 in bonds to enlarge the municipal electric lighting plant.

BOISE, IDAHO.—The Boise & Interurban Railway Company has decided to construct a street railway line in Caldwell and to extend its present line from that city to the Canyon County fair grounds, which are located about a mile distant.

IDAHO FALLS, IDAHO.—The plant of the Idaho Power & Transmission Company has been completed and is now in operation. The company is negotiating with the city of Idaho Falls to furnish electricity for the municipal lighting system and for pumping, which will require about 200 horse-power. A transmission line is now under construction in the valley reaching the towns of Ammon, Lincoln, Iona, Elva and Rigby and possibly Rexburg. The line to Rigby will be 24 miles in length. The company is contemplating installing another unit of about 500 kw, to be completed by the latter part of the year.

CHERRY VALLEY, ILL.—W. H. Poulton and W. W. Mockey have purchased the Cherry Valley mills and electric plant. The new owners contemplate making improvements to the plant and installing new machinery.

CHICAGO, ILL.—Oscar Heineman, silk manufacturer, will erect a three-story building at a cost of $135,000. The machinery will be driven by electricity.

CHICAGO, ILL.—Certificates of consolidation of the Chicago Edison Company and the Commonwealth Electric Company have been filed. The consolidated company will be known as the Commonwealth Edison Company. The board of directors consists of nine members as follows: Henry A. Blair, Edward L. Brewster, Joseph Leiter, Robert T. Lincoln, John J. Mitchell, Erskine M. Phelps, Lambert Tree, A. A. Sprague and Samuel Insull. The capital stock of the company is $30,000,000.

CRESTON, ILL.—The capital stock of the County Mutual Telephone Company has been increased from $2,500 to $6,000.

JACKSONVILLE, ILL.—Plans are being considered for the construction of an electric lighting plant in this place.

KINGSTON, ILL.—Frank W. Plane, of Belvidere, manager of the Boone County Rural Telephone Company, has been granted a franchise by the village board to extend the telephone system from Belvidere to Kingston.

ROCK GROVE, ILL.—The capital stock of the Rock Grove Farmers' Mutual Telephone Company has been increased from $1,200 to $6,000.

CRAWFORDSVILLE, IND.—The Commissioners of Montgomery County have granted a franchise to the Chicago & Western Indiana Traction Company to construct and operate an electric railway through the county.

GOSHEN, IND.—The Bonita Furniture Company, of this city, has started its new addition, 140 x 60 feet, two stories high, entirely equipped with electric motors. The motors were installed by the Hawks Electric Company. The main factory, 750 x 56 feet, will also be equipped with electric machinery.

HUNTINGTON, IND.—The Huntington Light & Fuel Company has notified its patrons of a reduction in the minimum rate of $1.00 to 50 cents a month. The present rate is 25 cents per kw-hour.

INDIANAPOLIS, IND.—Formal announcement has been made of the intention of Frank Fauvre, of this city, head of the Fauvre Coal Company, of Terre Haute, to establish a large electric power plant near Seelyville to transmit electricity to this city and other points in this section. A company will soon be formed with a capital stock of $1,000,000. The company has acquired the property of the People's Light & Heat Company, which includes a franchise covering the whole city, until 1930.

PRINCETON, IND.—The Evansville & Southern Indiana Traction Company has awarded the contract for the construction of its extension from this city to Patoka, a distance of four and one-half miles, to Jones Brothers, of Columbus.

WATERLOO, IND.—The Home Telephone Company is said to be making preparations to construct and equip a new and modern exchange and to extend its lines to Fort Wayne and other points. The company has recently reorganized.

TAHLEQUAH, I. T.—The telephone exchange of the Pioneer Telephone & Telegraph Company is reported to have been destroyed by fire Sept. 18, causing a loss of $5,000.

DECORAH, IA.—The Standard Telephone Company is planning to rebuild the local telephone exchange.

FORT MADISON, IA.—The Fort Madison Street Railway has been sold to the Mississippi Valley Electric Company, projectors of the Madison, Nauvoo & Carthage Interurban line, now under construction.

NEWTON, IA.—Extensive improvements and additions will be made to the municipal electric light plant and new machinery and equipment will be installed as follows: One 560-hp Murray boiler, Murray engine of 560-hp, 560-kw, Westinghouse generator and a five panel switchboard. A. C. Gates is superintendent.

OSAGE, IA.—The Osage Electric Light & Power Company has applied for a license, which will permit it to raise the dam across the Cedar River about 24 inches. The company states that the present dam will not supply sufficient power to operate the present lighting system of the company.

WATERLOO, IA.—The directors of the Corn Belt Telephone Company have decided to increase the capital stock of the company from $300,000 to $500,000 to provide for the great increase in business.

JACKSON, KY.—Repairs to the local electric light plant have been completed and will soon be put in operation, after lying idle for three years. The plant has been purchased by a new company.

LOUISVILLE, KY.—Bids will be received until Sept. 27 by the Board of Public Works for a new power plant and steam heating apparatus in the City Hall annex and old engine house and for remodeling apparatus in the old City Hall.

MIDDLEBORO, KY.—Judge Moss, of the Circuit Court, has appointed Henry Steele as receiver for the East Tennessee Telephone Company in Bell County.

MIDDLESBORO, KY.—C. W. Chandler, of London, has purchased the telephone franchise, which was sold at public auction Sept. 7 for $650. Mr. Chandler and associates operate telephone systems in London and Pineville.

PADUCAH, KY.—The Southern Construction Company has awarded a contract to the American Engineering Company, of Indianapolis, to survey a route for the interurban railway projected from Hickman to Paducah. Two routes have already been surveyed and rights of way have been secured.

WHITECASTLE, LA.—The City Council is considering a proposition submitted by Alphonso Kahn to furnish electricity for lighting the city. Dr. E. A. Pierce is Mayor.

PORTLAND, ME.—F. E. Ebersole has been appointed receiver for the Northeastern Telephone Company by Justice Peabody of the Supreme Court. A bill in equity was filed by the Portland Trust Company, declaring that the company had defaulted interest on its bonds and asked that a receiver be appointed.

BERLIN, MD.—Orlando Harrison, Mayor, writes that the City Council has decided to extend the time for granting of the franchise for water works and electric light plant from Sept. 20 to Oct. 31, with the prospect of placing an ice plant in connection with same.

FOREST GLEN, MD.—The Forest Glen Land Company is contemplating the construction of a central lighting and heating plant in this town. B. Wood Burch, Equitable Building, Baltimore, is president of the company.

AMESBURY, MASS.—It is reported that the Hamilton Woolen Company has awarded a contract to the M. B. Foster Electric Company, of Boston, for the installation of an electric lighting plant at an estimated cost of $1,000.

AMHERST, MASS.—The water privileges of the "Bobbin Hollow" pond have been purchased by the Ludlow Manufacturing Company and a new power plant will be installed.

BAY CITY, MICH.—It is reported that the E. I. Dupont Powder Company has decided to install an electric power plant at the chemical plant. Work will soon commence on the construction of the power house.

BERRIEN SPRINGS, MICH.—The citizens have voted in favor of issuing $17,000 in water and lighting bonds.

GRAND RAPIDS, MICH.—The Citizens' Telephone Company has increased its capital stock from $3,000,000 to $3,500,000.

STANDISH, MICH.—The electric light plant of the Citizens' Manufacturing Company was recently destroyed by fire.

COLLINS, MISS.—An election will soon be held to vote on the proposition to issue $5,000 in bonds to extend the electric light and water plant.

COLUMBIA, MISS.—The Town Council has granted a 25-year franchise to Grayson & Elder, of Biloxi, to erect and maintain an electric light plant in Columbia. It is agreed to have the plant in operation within eight months and to install a 20-ton ice plant.

FOREST, MISS.—The Forest Ginning & Manufacturing Company is planning to install an electric lighting plant to furnish electricity for lighting the town. E. Cahn, of Meridian, is interested in the project.

OXFORD, MISS.—The trustees of the University of Mississippi have decided to rebuild the power house and electric light plant, which was recently destroyed by fire.

MEADVILLE, MO.—J. D. Dunn, of Meadville, writes that nothing definite has yet been done toward the construction of an electric light plant.

ST. JAMES, MO.—Plans are being made for the erection of a new power house at the Soldiers' Home to take the place of the one recently destroyed by fire. The State Legislature has appropriated $10,000 for the erection of a new plant. The old plant was insured for $2,800, which will give $12,800 with which to erect the new plant. Captain H. E. Warren is president of the executive board.

FREMONT, NEB.—J. W. Andrews, city engineer, writes that bids will be received on Sept. 30 for the construction of building and smokestack for the municipal light and water works plant. Contracts for engines, boilers and dynamos have been let.

RENO, NEV.—The construction of a 42,000-hp plant to supply the cities of Nevada, also Marysville and the northern part of the Sacramento Valley in California with electricity, is the scheme of Dick Phelan. The promoter has already started the construction work and is in Reno seeking the aid of the prominent business men. Mr. Phelan owns six lakes just across the California border, near Sierra City, Gold Lake, Eagle Lake and the Four Bear lakes, and he also controls the water rights on the upper streams of the Feather and North Yuba rivers. He estimates that he can install a system for Reno at a cost of $50,000 and reduce the rate for power one-half. Mr. Phelan is general manager of the Sierra Mercantile Mining & Power Company, which also contemplates building an electric line from Marysville to Reno.

ATLANTIC CITY, N. J.—Chairman Donnelly, of the Council lighting board, is reported to have approved the plans for the system of illumination for Atlantic Avenue as prepared by Carrere & Hastings, of New York, N. Y. It is said that the City Council will authorize a bond issue of $30,000 to provide for installing the system.

BELVIDERE, N. J.—The Easton & Washington Street Railway Company is contemplating building its line through the town from the Oxford township line to the Delaware River.

DOVER, N. J.—The Dover Electric Light Company is building duplicate transmission lines from its power station in Dover to supply electricity in Rockaway. E. L. Thompson, owner of the Dover plant, has recently secured control of the Rockaway Electric Light & Improvement Company and plans to light Rockaway from the Dover plant. It is expected that the Rockaway plant will be dismantled.

HAMMONTON, N. J.—The Town Council has contracted with the Hammonton Electric Light Company and the Hammonton & Egg Harbor City Gas Company to light the streets of the city for a term of five years. The contract amounts to about $4,000 per year.

JERSEY CITY, N. J.—The Street and Water Board has adopted a resolution directing the Public Service Corporation to place all its electric wires on Grove Street, between Grand Street and Newark Avenue, underground as soon as possible.

MORRISTOWN, N. J.—The Public Service Corporation of New Jersey, as lessee of the United Electric Company, will contest in court the lighting contract awarded to the new company, and has applied for a writ of certiorari to review the granting of a public lighting contract to the Morris & Somerset Electric Company.

PALMYRA, N. J.—The Township Committee is arranging for a better system of street lighting. For several years the streets have been lighted by electricity, but during the last few months the service has been very unsatisfactory, and it is probable that gas may be tried. Bids for lighting have been asked from the Cinnaminson Electric Light, Heat & Power Company, which now has the contract, and the Public Service Corporation. The township is now paying $90 per lamp per year.

WHARTON, N. J.—The Borough Council has entered into a contract with the Dover Electric Light Company to light the streets of the borough for a term of five years from Jan. 1, 1908. By the terms of the contract the company is to install 75 incandescent lamps of 25 cp, to cost $20 per lamp per year. After 80 lamps have been installed the cost is to be $18 per year for each additional lamp. The contract will amount to about $1,500 a year.

BROOKLYN, N. Y.—The New York & New Jersey Telephone Company is taking down from 75 miles to 100 miles of wire in the Fifth

Ward, including Rockaway, and is removing about 200 poles, preparing to place its wires in subways. The entire work is to be completed before winter. The work of removing poles and wires in Richmond is also being pushed rapidly.

CANANDAIGUA, N. Y.—Plans are now under consideration by the Canandaigua Southern Electric Railroad Company for extending the road from Atlanta to Wayland, and thence by the way of Pittsburg and Shawmut line to Hornell. It is proposed to electrify the Pittsburg and Shawmut road from a point just outside of Wayland to Hornell, and the cars of the Canandaigua Southern road will run from Canandaigua, through Naples, Cohocton, Atlanta and Wayland, to Hornell.

DUNKIRK, N. Y.—The American Locomotive Company is asking for bids for the construction of a $30,000 power house, to be erected on the Roberts Road.

FLUSHING, N. Y.—Bids will be received until Sept. 30 by C. B. J. Snyder, superintendent school buildings, New York, N. Y., for installing ventilating, heating and electric generating apparatus and electric elevator in the Parental School, Flushing, Borough of Queens.

HEMPSTEAD, N. Y.—The Highway Commissioners of Hempstead have granted the South Shore Traction Company a franchise to build an electric railway from Central Avenue to the town line at Seaford.

NEW YORK, N. Y.—Bids will be received until Sept. 30 by C. B. J. Snyder, superintendent school buildings, for installing electric equipment in addition to and alterations in School 59, Borough of Manhattan.

NEW YORK, N. Y.—The Direct Line Telephone Company has been incorporated with a capital stock of $1,000,000 to manufacture all kinds of telephone apparatus and to establish a system of telephone lines. The incorporators are A. Koch Andriano, of San Francisco, Cal.; John A. Potter and Charles W. Smith, of New York City.

NEW YORK, N. Y.—Commissioner John O'Brien, of the Department of Water Supply, Gas and Electricity, has notified the New York Central Railroad Company that it must place its high-tension electric wires between Spuyten Duyvil and 96th Street underground.

SYRACUSE, N. Y.—The Board of Trustees of East Syracuse has granted the Syracuse Rapid Transit Company a franchise to construct a double track railway in that town.

SYRACUSE, N. Y.—The lighting commission, appointed by Mayor A. C. Fobes, to investigate the lighting situation as affecting the city and consumers of gas and electricity, has advised against municipal ownership of a lighting plant at the present time, but recommends that steps be taken to secure authority for the erection of a plant for lighting streets, parks and public buildings, subject to approval of voters; the commission also favors the construction of a municipal subway system. Prof. Delmar E. Hawkin is secretary of the commission.

SENECA, N. C.—The Council is reported to be considering the question of establishing an electric light plant.

ENDERLIN, N. D.—The plant of the Enderlin Electric Light & Power Company has been completed and is now in operation. The company is contemplating extending its lines to Sheldon, a distance of eight miles, to furnish electricity to light the town, and also expects to double the capacity of the plant within 18 months. The equipment of the plant consists of a 60-kw, single-phase, 60-cycle, 2200-volt Westinghouse alternator, and 85-hp Buckeye engine and a 60 x 16 boiler made by the North Star Iron Works, of Minneapolis, Minn. M. A. Abbott is vice-president and manager.

GRAND FORKS, N. D.—The Northwestern Interurban Railway Company has applied to the City Council for a franchise to construct and operate a street railway in the city. The company proposes to construct a railway from Grand Forks to Carrington in connection with the local system.

CLEVELAND, OHIO.—The Youngstown & Ohio River Railway Company has filed a mortgage to the Citizens' Savings & Trust Company, of this city, to secure an issue of $2,500,000 in bonds. Of this amount $1,500,000 will be issued to cover the cost of construction of the road, while the remainder will be retained for future use. The company is building an electric railway from the terminus of the Salem Railroad Company in Salem to a connection with the tracks of the Stark Electric Railway. A line is also being built from a connection with the Salem Railroad Company's line at Washingtonville through Leetonia, Lisbon and West Point to East Liverpool, a distance of 38 miles. The Cleveland Construction Company, of which Warren Bicknell is president, is doing the construction work.

COLUMBUS, OHIO.—J. C. Gillett and G. D. Ridenour have made application to the State Board of Public Works for a lease of the abandoned Hocking Canal from its junction with the Ohio Canal at Carroll to its terminus at Nelsonville for electrical railway purposes.

COLUMBUS, OHIO.—George Stockton, superintendent of Columbus State Hospital, writes that contracts were let on Sept. 17 for the addition to the power plant as follows: Engine, to the Ironton Engine Company, of Ironton, for $2,498; dynamos and switchboard to F. Bissell Company, of Toledo, for $3,555.

DELTA, OHIO.—The Delta Electric Light Company has applied to the City Council for a water works franchise in this place.

LOCKLAND, OHIO.—The Fitzsimmons Independent Telephone Company has applied to the Council for a franchise in this village.

MT. WASHINGTON, OHIO.—The Suburban Power & Lighting Company is negotiating with the village of Mt. Washington for two lighting franchises. The first involves a 10-year franchise for lighting the streets, and the second for a 25-year franchise for commercial lighting privileges. The street lighting is now furnished by gasoline lamps.

NORWALK, OHIO.—Sherman Culp, vice-president of the Sandusky, Norwalk & Mansfield Electric Railway Company, is projecting a line between Norwalk and Sandusky, which, it is said, will shorten the distance traversed by other lines. Mr. Culp states that capital has been interested in the road and that it will be built within a year or two.

RAWSON, OHIO.—F. P. Folk, city clerk, writes that the Council has taken no definite action, but will probably construct an electric light plant. For further information address E. W. Burkett, Mayor.

TOLEDO, OHIO.—The County Commissioners have granted a franchise to the Toledo & Delphos Electric Railway Company to use the streets in Neapolis. The line when completed will be known as the Toledo, Wabash & St. Louis Railway. It is the intention of the promoters to construct the line through to St. Louis by the way of Wabash.

ELDORADO, OKLA.—W. B. Bryan and W. B. McKenney, of Mangum, Okla., are members of an electric company that are considering the erection of a plant in this town. The company has secured a franchise and 500 service contracts. Application for charter has been made.

KLAMATH FALLS, ORE.—The Klamath Falls Light & Water Company, which has already expended a large sum of money in the improvement of its system this year, is planning still further extensions. The system will be extended out to the Hot Springs addition on the east, and into Lakeside and Riverside additions on the west side. Besides laying the pipe lines the company will construct two new storage reservoirs, one near the end of the Esplanade in Hot Springs, and the other on the hill across the river.

MARSHFIELD, ORE.—The Coos Bay Gas & Electric Company is planning to increase the capacity of its plant and will soon install four new 100-hp boilers, one 650-hp simplex Corliss heavy duty engine, a 450-kw, 3-phase, 60-cycle, alternating-current dynamo, and a direct-current generator of 250 kw capacity. The company will also be in the market for two street cars and equipment and a number of alternating-current motors and transformers. Seymour H. Bell is treasurer and manager.

ALLEGHENY, PA.—The City Council has passed the ordinance for the issue of $75,000 in bonds for the purchase of a turbo-generator set for the municipal electric light plant.

EASTON, PA.—It is reported that a new electric railway is to be built between Easton and Flemington, to be in operation about July 1, 1908. The proposed route will run from Phillipsburg via Springtown, High Bridge, Lansdowne to Flemington. It is proposed to erect a power house at Hampton Junction to supply electricity to operate the road.

HARRISBURG, PA.—The Pennsylvania Central Telephone Company, which has operated all the Bell exchanges in this part of the state, has been merged with the Bell company of Philadelphia. The headquarters of the Pennsylvania company will be transferred to Philadelphia.

HUNTINGDON, PA.—Contracts will soon be let by the Raystown Water & Water Power Company for the construction of dam No. 1 in connection with the hydro-electric project being promoted by the company. The specifications call for a dam about 500 feet long and 30 feet high. Between 5000 and 6000 horse-power will be developed.

JOHNSTOWN, PA.—J. R. Potter & Company, of Philadelphia, have been awarded the contract for grading the new electric railway of the Southern Cambria Company, between Johnstown and South Fork.

LANCASTER, PA.—The management of the Oxford & Southern Railroad has decided to convert it into an electric road, and will secure electricity to operate the road from the power plant of the McCall Ferry Company on the Susquehanna River.

LANCASTER, PA.—Notice has been filed in the State Department by the Lancaster & York Furnace Electric Railway Company of an extension of route from Pequea to York Furnace Springs, Mount Nebo and McCall Ferry, a distance of eight miles. Frederic Shaff is president.

LEBANON, PA.—The Cornwall Ore Bank Company is contemplating the construction of a large power plant at Lebanon and will transmit electricity to Cornwall to operate the machinery for crushing iron ore, etc. Quincy Bent, manager of the Pennsylvania Steel Company, is interested in the enterprise.

LOCK HAVEN, PA.—Work has commenced on enlarging the power house and car barn of the Susquehanna Traction Company.

PITTSBURG, PA.—The Bureau of Building Inspection has granted a permit to the Convent of Mercy to erect a two-story power house on Fifth Avenue to cost $25,000.

ROYER, PA.—Frank W. Moore, of Indiana, Pa., engineer, writes that the proposed electric light plant to furnish electricity for lighting and power in Williamsburg, Martinsburg and Royer will cost about $45,000. Bids will probably not be called for until 1908.

SCRANTON, PA.—The Clark, Summit & Lake Winola Street Railway Company has been granted franchises by the townships of Abington, Newton Falls and Overfield to operate a street railway through the towns.

TREVORTON, PA.—The North Franklin Colliery has recently been equipped with electrical machinery to operate the mines. The machinery was installed by the General Electric Company.

WAYNESBURG, PA.—The Pittsburg Railways Company has completed plans for an extension of its interurban system from Finleyville on the Pittsburg-Charleroi line to Bentleyville, thence to Waynesburg.

WAYNESBORO, PA.—The application of the Chambersburg, Greencastle & Waynesboro Street Railway Company for an extension of its system from Greencastle to Chambersburg has been approved by Governor Stuart. The company has been reorganized and will increase its capital stock, which increase has been practically all subscribed by local people, which had previously organized the Chambersburg & Southern Electric Railway Company, which has been merged with the Chambersburg, Greencastle & Waynesboro Company.

WOMELSDORF, PA.—W. W. Lengel, borough secretary, writes that the citizens voted on Sept 13 to issue bonds for the construction of a municipal electric light plant. F. W. Darlington, Real Estate Trust Building, Philadelphia, is engineer.

YORK, PA.—Arrangements are being made to consolidate the York & Wrightsville, York & Dallastown, Red Lion & Windsor, York & Dover, York & Hanover and the York Street Railway companies. The Wrightsville & York Street Railway has filed notice of an increase in its capital stock from $66,000 to $3,397,000. It is announced that the Wrightsville & York Company will be the medium through which the capital will be provided for improvements and extensions contemplated. It is proposed to extend a line into Harrisburg in the near future, surveys for which have already been made. The consolidation will be known as the York Railways Company.

PANAMA.—Bids will be received at the office of H. F. Hodges, general purchasing officer, Isthmian Canal Commission, Washington, D. C., until Oct. 14, for automatic fire alarm telegraph systems, marine electric fixtures, batteries, dynamite and blasting material, wire hoisting engines, etc.

WESTERLY, R. I.—The Westerly Railway & Lighting Company has awarded to R. A. Sherman's Sons Company the contract to erect a substation at Stonington. The company is now erecting a transmission line between Westerly and Stonington to transmit electricity to that borough for lighting purposes.

BISHOPVILLE, S. C.—Owing to the installation of a new engine and other improvements being made to the plant of the Bishopville Light & Power Company, the streets of the town are not lighted at night. The Town Council made a contract with the Lee County Manufacturing Company to furnish power for the dynamo until the new engine could be installed, but the company failed to comply with the agreement, and the town will be in darkness until the engine is placed. It is expectetd to have the plant in operation by October 1.

EASLEY, S. C.—John C. Cary, of Lockhart, S. C., is interested in a project to establish a plant at Dunham's Bridge, about five miles from Easley, to develop the water power of the Saluda River.

McCORMICK, S. C.—Paul B. Wilson, of Abbeyville, S. C., has been awarded the contract to install a 35-hp electric lighting and power plant. The contract calls for 360 incandescent lamps, of which eight of 100 cp are for the streets.

SENECA, S. C.—The city clerk writes that bonds have been issued for the construction of an electric light plant.

UNION, S. C.—Plans are being made to improve the electric lighting service furnished by the municipal electric lighting plant. E. M. Anderson, superintendent, has left for New York with authority to purchase a new dynamo, which will be installed as soon as possible.

VERMILLION, S. D.—The Northwestern Telephone Company has been served with notice to vacate the public highways within 60 days. For two years the company has been operating without a franchise, and its refusal to accept one proposed by the City Council, which calls for a tax of three per cent of the gross earnings of the local exchange and a reduction of 25 per cent in the charge for private lines, has resulted in the order to vacate. A local company, headed by former Governor Andrew E. Lee, wants the franchise.

CHATTANOOGA, TENN.—It is reported that the Tennessee Construction Company, recently chartered under the laws of West Virginia, is to build the Georgia-Tennessee Interurban Electric Railway, which is being promoted by S. W. Divide. It is understood that the company will construct the road from Chattanooga to Chickamauga Park. The Tennessee company has elected the following named officers: Samuel B. Smith, president; S. W. Divide, vice-president; W. M. Elliott, secretary and treasurer. Surveys have been completed and the rights of way purchased for the road as far as Chickamauga Park and beyond to Catoosa Springs.

CLARKSVILLE, TENN.—Because of a controversy between the Cumberland Telephone Company and the City Council, the Mayor ordered the wires and cables of the company cut, putting two-thirds of the company's plant out of commission. An injunction has been granted by Judge Stout enjoining the City Council from interfering with the wires. It is understood that the company will repair the lines at once. The matter of placing the wires underground will be decided in the courts.

KNOXVILLE, TENN.—The Central Telephone Company has purchased from the Gainesboro Company all its lines, telephones and exchanges in Morgan and Scott counties, Tenn., and Whitney County, Ky.

MEMPHIS, TENN.—Application has been made to the City Council by K. D. McKellar, representing the Memphis Light & Traction Company, for a franchise to operate a street railway in the city.

NASHVILLE, TENN.—A special election will be held Oct. 10 for the purpose of voting on the proposition of issuing $400,000 in bonds for the enlargement of the municipal electric lighting plant to provide for additional street lighting. G. R. Morrow is supervisor.

AMARILLO, TEX.—The City Council has instructed the city attorney to draw up an ordinance submitting a proposition to the people for bonding the town to build or purchase and maintain a water and light system.

FORT WORTH, TEX.—The Northern Texas Traction Company, it is said, is contemplating doubling the capacity of its power house, which will involve an expenditure of about $150,000.

SAN ANGELO, TEX.—The San Angelo Water Works Company is changing its system from 133 to 60 cycles, three-phase, and is also installing a 300-kw turbo generator set. W. A. Guthrie is manager.

WACO, TEX.—Joseph J. Henry, vice-president of the Consumers' Light & Power Company, has closed contracts for machinery, etc., for the new plant, and states that it will be ready for operation by Dec. 1.

SALT LAKE CITY, UTAH.—The Utah Lake Land, Water & Power Company has filed an amendment to its articles of incorporation with the county clerk. M. B. Whitney is named as president and R. H. Thomson, secretary. The capital stock of the company is $620,000.

SALT LAKE CITY, UTAH.—Plans have been completed for the reorganization of the Utah Independent Telephone Company. Heber J. Grant & Company will be in charge of the reorganization. It is proposed to raise $1,200,000, which will be sufficient to acquire all bonds and stocks and pay off the indebtedness of the company, and in addition will provide, approximately, $75,000 for new installation. In addition it is proposed to put $300,000 in bonds into the treasury as a reserve for future extensions and to cancel the remainder of the bond issue, and to increase the capital stock from $1,000,000 to $1,300,000.

FORT ETHAN ALLEN, VT.—Bids will be received until Sept. 28 at the office of the constructing quartermaster at Fort Ethan Allen for the construction, plumbing, wiring and fixtures for electric lighting of one brick double set civilians' quarters at this post. Proposals should be addressed to Lieut. M. G. Holliday, quartermaster.

RICHFORD, VT.—The firm of Sweat & Cumings is building a flume 200 feet long, which will extend from the mill dam to the site of the new electric power plant, which is to be completed by Jan. 1 at a cost of $35,000. The water company will furnish 450 horse-power for the electric plant. The plant when completed will furnish electricity to operate the furniture factory, grist mill and sawmill.

FREDERICKSBURG, VA.—The City Council has voted to appropriate $4,000 to install an incandescent lighting system in the municipal electric light plant for lighting private residences and stores.

BUCKLEY, WASH.—The plant of the Buckley Electric Company is being enlarged to meet the increasing demands for electricity. The company has purchased a 75-kw generator and an engine of 125-hp capacity, which will be installed at once.

CENTRALIA, WASH.—B. E. Clements, of the Independent Telephone Company, of Portland, Ore., has been granted a franchise to install a local telephone system in connection with the Northwestern long distance system.

RAYMOND, WASH.—The City Council has instructed the city attorney to notify the Pacific States Telephone Company that it would be allowed 15 days in which to make application for a franchise to do business in this city. In case the company fails to make application its poles will be removed.

SEATTLE, WASH.—Owing to the municipal electric lighting plant having reached the limit of its capacity, the lights and lighting committee of the City Council has decided to authorize the superintendent of lighting to purchase electricity from private concerns if possible. The new extensions to the plant, which will more than double its present capacity, will not be completed for six months.

SPOKANE, WASH.—The Washington Power Company is planning to build a power transmission line into Big Bend County, west of Spokane. Electricity will be furnished for lighting towns and operating manufacturing plants and mills at Davenport, Ritzville, Reardan, Harrington, Sprague and Paha. The company expects to have the transmission line from Post Falls to the Cœur d'Alene mining district completed within two months.

SPOKANE, WASH.—Announcement has been made that the Power Development Company, which is a subsidiary of the Spokane & Inland Railroad Company, will have a surplus of from 10,000 to 15,000 hp from the new power plant at Nine Mile Bridge when completed. It is proposed to utilize the power by supplying electricity for lighting and power in Spokane, under the franchise purchased by Jay P. Graves and associates from Frank P. Hogan. The plant was built to furnish electricity to operate the Spokane & Inland Railway system.

SPOKANE, WASH.—The Big Bend Water Power Company has applied to the City Council for a 50-year franchise to lay conduits and erect transmission lines to furnish electricity for commercial purposes in Spokane. The measure provides that the company shall build a power plant 28 miles down the Spokane River and have it in operation in three years. It is estimated that 20,000 horse-power can be developed. The company proposes to operate 132 miles of electric railway and to furnish electricity for lighting and power purposes in Spokane. The plant, including duplicate transmission lines, it is stated, will cost $2,000,000. The dam will be 100 feet high and 489 feet wide. The power house will occupy the middle of the dam and over the channel of the river, the cost of which is placed at $400,000. There will be seven 10-foot steel conduits leading through the dam wall to seven pairs of turbines. The dam will raise the river for a distance of 14 miles, creating a reservoir with a capacity of 12,000,000

cubic feet. Besides supplying electricity in Spokane, the company is planning to supply various mines in the Cœur d'Alene district and a transmission line to Murray, a distance of 132 miles, is under consideration. R. C. Lowry, of Seattle, is engineer for the company, and J. E. Ross, of Seattle, is electrical engineer.

BLUEFIELD, W. VA.—A franchise has been granted by the City Council to E. L. Bailey and E. T. Oliver to erect poles and wires on the streets of the city to operate a street railway system and to manufacture and distribute electricity.

CHARLESTON, W. VA.—A charter has been granted to the Elkins Power Company to operate an electric railway in Randolph, Taylor and Barbour counties. The company is capitalized at $75,000, and the incorporators are H. G. Davis and others.

PADEN CITY, W. VA.—Work has commenced on the construction of the new plant of the Pittsburg Chain & Forge Company, of Pittsburg. Plans have been prepared for the erection of an ironclad building 60 x 100 feet, to be devoted to the manufacture of hand-made chains for dredge and crane service. A power plant will be installed in the building, consisting of a gas engine and generator to furnish electricity for lighting the building and power for the motor-driven machinery, including a 200,000-pound testing machine, forges, etc.

CONCONCULLY, WIS.—The construction of a telephone line between Twist and Conconcully is under consideration. An organization has been effected by the election of L. H. Bowman, chairman, and E. F. Magee, secretary. The proposition is for the citizens of the county and the United States Forest Service to co-operate in building the line, the Government to furnish the wire and the citizens to do the rest.

EAGLE RIVER, WIS.—The town is building a reservoir on the Eagle River, about three and one-half miles west of the town, which will supply power for the electric light plant and water works system, and will also furnish water power for factories and other industries. The dam when completed will cost about $100,000 and will furnish 1000 horse-power.

MADISON, WIS.—John Corscot, general manager of the Madison Gas & Electric Company, writes that the company is installing an Allis-Chalmers steam turbine of 500-kw capacity, and a 500-hp Sterling boiler, with the necessary pumps, heaters and other accessories in its plant at a cost of about $75,000. The work will be completed in a month or six weeks.

MADISON, WIS.—The Railroad Commission has received petitions from five utility corporations for authority to increase their rates for service. The companies asking for permission to increase their rates are the Merrill Electric Railway Light & Power Company, of Merrill; the Fox River Electric Light & Power Company, of Pardeeville; the Colby Telephone Company, of Colby; the Brodhead Telephone Company, of Brodhead, and the Watson Heating Company, of Marinette.

MENOMONEE FALLS, WIS.—The Menomonee Falls Telephone Company has acquired by purchase the Richfield, Menomonee and the Holy Hill Telephone Company's lines, which will extend the local company's lines into new territory, including Goldenthal, Richfield, Plat, Hubertus and other points.

NEENAH, WIS.—Arrangements are being made by the Wisconsin Telephone Company for the construction of a new telephone exchange building on Commercial Street, the cost of which is estimated at $75,000.

PRENTICE, WIS.—The Prentice Light, Water & Light Company has been granted a lighting franchise, and work will be started at once on the installation of the system.

SPARTA, WIS.—The La Crosse Water Power Company has entered into a contract with the Sparta-Melrose Electric Railway Company to furnish electricity to operate its road.

RAWLINS, WYO.—Local business men have formed a telephone company and propose to install a local exchange.

AMHERST, N. S.—The Maritime Coal, Railway & Power Company has installed an electric plant at its mines, located about eight miles from Amherst. The power plant has a capacity of 600 horse-power. Provision has been made for the addition of a second unit when necessary.

BRANTFORD, ONT.—Contracts will shortly be awarded by the Grand Valley Radial Company for the construction of a railway between Brantford and Port Dover, a distance of 34 miles.

CHATHAM, ONT.—The Chatham, Wallaceburg & Lake Erie Railway Company is planning to extend its road from its terminus at Lake Erie to Wallaceburg. Robert E. Kizer is general manager.

LONDON, ONT.—O. Ellwood, secretary, writes that John E. Moore is engineer in charge of the water system and power plant which is to be installed in London at a cost of about $575,000. The date of opening bids for construction has not yet been decided upon.

KINGSTON, ONT.—The contract for the construction of the power house of the Sydney & Glace Bay Railways, at Dominion No. 4, has been awarded to Rhodes, Curry & Company, of Amherst, N. S. The cost of the plant and machinery is estimated at $25,000.

GUADALAJARA, MEX.—The Compania de Tranvias, Luz y Fuerza, of Guadalajara, has under consideration the construction of a double transmission line from its Las Juntas hydro-electric plant on the Santiago River to the mining districts of Etzatlan and Hostotipaquillo. It is proposed to build branch lines to other mining camps in the state of Jalisco. It is estimated that the cost of building the double main line will be $960,000. The company has submitted a proposition to the mining men of the districts to be reached, which is, in substance, that they advance one-half the sum of the cost of the proposed double line, the loan to be paid off with power and the money thus advanced to draw 8 per cent per annum. The price to be asked by the company for the electrical energy is $120 a horse-power per annum.

MEXICO CITY, MEX.—The Compania Electrica del Alameda has been organized to furnish electricity in this city, and has obtained a concession from the Federal government for the system, and has also made the necessary money deposit as a guaranty that it will live up to the terms of the concession. The company will build a large hydro-electric plant at the waterfall of Rio Alameda, situated about forty miles from Mexico City, and will erect transmission lines from the plant to this city. The company already has a power plant at the waterfall, which is to be enlarged. The new plant will have a capacity of about 8000-hp. The firm of Donadiue & Veyan, of this city, are largely interested in the new project.

MOLINO DEL PROGRESO, MEX.—José Martinez and associates have taken steps to erect a hydro-electric plant on the Tula River, state of Hidalgo, near the town of Molino del Progreso. The power will be used for industrial purposes.

SABINAS, MEX.—A large electric power plant is to be erected at Sabinas, state of Coahuila, by Dr. Braulio Montemayor, of Saltillo, and associates. Transmission lines will be built to a number of industrial centers of that part of Mexico.

SAN NICOLAS DE LA JOYA, MEX.—The Canadian Electric syndicate has had plans prepared for a hydro-electric plant, which it will install at San Nicolas de la Joya on the Conchos River, in the state of Chihuahua. W. F. Tye, an electrical engineer, is in charge of the project. The initial power will be obtained by constructing a large dam across the Conchos River. It is expected that more that 2500-hp will be developed. Transmission lines will be built to the cities of Parral, Chihuahua, Santa Rosalia, Jiminez and to a number of mining districts.

TEZUITLAN, MEX.—The Tezuitlan Copper Mining & Smelting Company has begun the erection of a hydro-electric plant near its mines at Tezuitlan, state of Vera Cruz. The plant is located on the Atoyac River. The power will be used to operate the machinery of the mine and smelter.

New Industrial Companies.

THE CONANT, WHITING & COMPANY, Inc., of Boston, Mass., has been incorporated with a capital stock of $4,000. The company proposes to do electrical engineering work. The incorporators are George H. Conant, Herbert S. Whiting and Eugene H. Mahoney.

THE GERMAN-AMERICAN ELECTRIC COMPANY, of New York, N. Y., has been incorporated with a capital stock of $100,000. The directors are Waldemar P. Leonhardt, Edith Grant and Arthur H. Grant.

THE F. C. NEWELL MUTOGRAPH CORPORATION has been organized under the laws of New Jersey, with a capital stock of $1,000,000, with headquarters at Cleveland, Ohio. The company has been formed to manufacture and place on the market the "Mutograph," an electric bulletin printing device invented by F. C. Newell. The officers of the company are as follows: F. C. Newell, president and consulting engineer; Benjamin B. Avery, vice-president; Charles E. Kennedy, secretary, and W. E. Telling, treasurer.

New Incorporations.

VAN BUREN, ARK.—The Van Buren Light & Fuel Company has been incorporated by James Brizzolara and others to establish an electric light plant.

GREENVILLE, KY.—The Greenville Light & Water Company has been organized with a capital stock of $35,000 to furnish light and water. J. A. Gilman is engineer.

KANSAS CITY, MO.—The E. S. Cowie Electric Company has been chartered with a capital stock of $10,000 by Ernest S. Cowie, Charles Pierson and G. H. Jewett.

ALAMOGORDO, N. M.—The Sacramento Power Company, of Alamogordo, has filed papers of incorporation at Santa Fé with $1,000,000 capital. The directors are U. S. Houghland and John A. Gilchrist, of Kansas City; M. and A. T. Payne, of Oklahoma City, Okla. A large storage dam will be built for irrigation purposes.

CIRCLEVILLE, OHIO.—The capital stock of the Circleville Light & Power Company has been increased from $70,000 to $80,000.

MANSFIELD, OHIO.—The Delaware, Mt. Gilead & Mansfield Electric Railway Company has been organized to build an electric railway. The officers of the company are: J. A. Shoemaker, of Delaware, president; S. P. Gage, of Mt. Gilead, secretary; A. H. Breese, of Mt. Gilead, treasurer.

GRANITE, OKLA.—The Granite Electric Company has been incorporated with a capital stock of $10,000 by K. C. Knox, H. J. Hayes and others.

MARKES, PA.—The Conooheagre Electric Light and Heat & Power Company has been incorporated with a capital stock of $30,000 by E. B. Duel, Seth Lehmaster, of Markes, and others.

SHARON, VT.—The Sharon Power Company has filed articles of association with the Secretary of State with a capital stock of $50,000. The company proposes to erect an electric plant to furnish electricity for lighting, heating and power purposes in Sharon.

Legal.

ALTERNATING CURRENT GENERATORS.—A motion for a preliminary injunction was brought in the United States Circuit Court for the Middle District of Tennessee by the General Electric Company against the city of Nashville, Tenn., to restrain the city from the further use of some Bullock alternating current generators. These generators have laminated pole pieces attached to the revolving field spider by means of bolts from the spider engaging a transverse bar embedded in the pole piece, a construction covered by the Parcelle patent No. 463,704, granted Nov. 24, 1891, which has been heretofore sustained by the courts. Judge Clark holds that the defendant has not produced any new matter tending to invalidate the patent and that, therefore, there is no reason why injunction should not issue, this patent having previously been held valid by the Court of Appeals for the Sixth Circuit of Cincinnati in the case against the Bullock Company on the same construction. The court allows the city of Nashville sixty days in which to change the pole pieces or to withdraw the machines from use entirely.

BOILER CLEANING DEVICE.—In the suit of the Liberty Manufacturing Company versus the American Brewing Company, in the United States Circuit Court for the Eastern District of Pennsylvania, an injunction for infringement has been granted by the court. The patent sued under was that of W. S. Elliott, covering a steam turbine cleaner for steam boilers. With this device is used a turbine of smaller diameter than the tube to be cleaned, which is attached to a hose. To the shaft of the turbine, which shaft may be provided with a universal joint to allow the device to follow the end curvature of tubes, is attached a head which constitutes the Elliott device. This head is provided with four longitudinally extending arms pivoted at their rear ends in inset openings at four equi-distant points on the periphery of the head. A set of two arms of longer length and a set of two of shorter length are mounted at right angles. On the forward, free end of each arm a toothed movable cutting wheel is mounted on a shaft extending lengthwise the arm. When the turbine shaft is rotated at high speed, the forward extending arms on the head by centrifugal force fly outward, bring the cutters in contact with the scale and deliver a rapid succession of blows on both a revolving and striking character. This blow is variously described in the proofs as a sidewise or swiping blow and the process is styled a picking action. By these blows the crust is broken into small pieces, which are washed out ahead of the device by the exhaust of the turbine. The court held that no weight should attach to the claim that Faber was a joint inventor with Elliott, and that the devices of Bradley and Weinland did not involve prior uses.

RIGHTS OF TELEPHONE COMPANIES IN MINNESOTA CITIES.—The question was recently put to the United States Circuit Court whether a telephone company had the legal right to establish a telephone exchange in a city in Minnesota, which would give local service to the citizens of the city and also long distance service to points without the state, without the consent of the local authorities. The Northwestern Telephone Exchange Company, having obtained authority from the city of St. Charles, Minn., to erect its lines in certain streets, proceeded to establish itself in other streets of the city. A statute of Minnesota gives telegraph and telephone companies the right to erect poles for their wires in any road or highway in the state, providing that they should not use streets or alleys in any city or village without obtaining a franchise from such city or village. It was argued by the company that it was engaged in interstate commerce and that the statute of a state restricting its rights was invalid as an interference with interstate commerce. The statute was held valid and the company was declared to have no right to occupy the streets of the city of St. Charles without first being properly authorized by the authorities of that city. While any interference by the Legislature with an established instrument of interstate commerce might be a subject of criticism, still the fact that a line of telegraph or telephone will, when completed and in use, be used for the purpose of interstate commerce, gives no right to the persons or corporations projecting the establishment of a concern of this kind to do so upon terms different from what others would be required to submit to in the establishment of a similar enterprise. Northwestern Telephone Exchange Company vs. City of St. Charles, 154 Fed. Rep. 386.

DOMESTIC PATENT EXPIRES WITH PRIOR FOREIGN PATENT ON SAME INVENTION.—The patent act provides that, if a patent is granted upon a device already covered by a foreign patent, the domestic patent shall expire at the same time that the foreign patent runs out. In a recent action to restrain an infringement of the Thomson patent No. 448,894, for an electric meter, issued March 24, 1891, this provision was depended upon as a defense, and it was shown that an English patent which expired in 1904 had been granted upon substantially the same device. The plaintiff claimed that, on account of certain additions to the original invention, the domestic patent covered a different invention from that protected by the English patent, and that, therefore, the case was not a proper one in which to apply the provision of the patent act mentioned. It was held that the additions made in the American patent did not constitute invention and that the American patent rights ceased with the expiration of the English patent. A patent cannot be exempted from the operation of the law by merely adding new improvements to the invention. Otherwise it would be possible to easily evade the statute. The claims of the respective patents which the plaintiff sought to differentiate were as follows: Claim 17 of Patent 432,654: "The combination, in an electric meter, of coils or sets of coils in moving relation one to the other, and placed, respectively, in the main and in a branch circuit or their equivalent, as described, and a copper plate and magnet for absorbing the dynamic energy of the coils carried upon the structure whose movements are registered to form a record of the current consumed." Claim 2 of British patent: "An electric meter having stationary coils in a main circuit, and movable coils forming an armature in a shunt circuit around the work, and a supplemental resistance in the said armature circuit; combined with a retarding device comprising a close conductor moving in a permanent and constant magnetic field, which is independent of and uninfluenced by the currents flowing in the aforesaid coils, for the purposes above specified." Thomson-Houston Electric Company vs. McLean, United States Circuit Court of Appeals, 153 Fed. Rep., 883.

Obituary.

MR. SAMUEL SLOAN, the well-known railroad president and manager, died this week in his ninetieth year. He left a deep mark on American railroad development. He was for many years a director in the Western Union Telegraph Company.

MR. J. EDWARD ALLEN, treasurer of the National Electric Light & Battery Company, Providence, R. I., died suddenly of apoplexy Sept. 13. Mr. Allen was 70 years of age and is survived by a widow and three sons and one daughter. He was well known among the Masonic bodies, and was president of the first Eastern League baseball club in Providence.

Personal.

H. M. HIRSCHBERG.

MR. H. M. HIRSCHBERG, president of the Excello Arc Lamp Company, of New York City, has just returned from a ten weeks' trip to Europe, in the interest of his company. As a result of the visit several new designs of flaming arc lamps will soon be placed on the American market. To the untiring energy of Mr. Hirschberg may be attributed a considerable portion of the present popularity of the flaming arc lamp in this country. He has concentrated his efforts during the past eighteen months on the introduction of the lamp and on the commercial exploitation of its advantages. The recent trip of Mr. Hirschberg to Europe involved his one hundred and tenth and one hundred and eleventh crossing of the Atlantic. Since his first trip across, in 1873, from England, where Mr. Hirschberg received his early training and education, he has been continuously associated with engineering and mechanical undertakings. He was among the first to introduce National Cash registers, check perforators and such like. Always musical, he dabbled locally in concert direction with such success that he, upon the suggestion of many leading musical artists, removed to New York in 1894 and went into the management of high-class musical attractions, introducing to American audiences many leading singers and instrumentalists. It was while visiting Europe in 1905, in search of new attractions in this field, that his attention was directed to the Excello flaming arc. Realizing its great commercial possibilities, he gave up the profession of impresario and secured the Excello rights for the United States and Canada. Mr. Hirschberg undertook it purely as a good business proposition and knew absolutely nothing then about electrical goods or illuminating projects. The success of his undertaking is too well known to need comment and is another striking illustration of what persistence and foresight can accomplish.

MR. C. A. COFFIN has returned home, his trip abroad being suddenly curtailed by the sad death of his only son, Mr. E. R. Coffin, as noted recently, at Omaha, Neb., while on a Pacific Coast journey.

MR. J. F. McLAUGHLIN has been appointed chief of the Electrical Bureau of the city of Philadelphia to take effect Oct. 1. He has been engaged for some years past in expert and consulting electrical work, and has taken out several patents.

MR. V. C. GILPIN, of 120 Liberty Street, New York City, has been made Eastern agent for the Pratt Chuck Company, Frankfort, N. Y., manufacturers of electro-galvanized pressed steel outlet boxes. He will carry a complete stock in New York.

MR. J. C. FARRAR has been appointed electrical engineer of the "Randolph Lines" in Arizona and Mexico, with headquarters in Tucson, Ariz. Mr. Farrar was formerly chief electrician of the motive power department of the Southern Pacific Company at Los Angeles, Cal.

MR. HENRY FLOY has just returned from a two months' trip through northern Italy and Switzerland. Mr. Floy was particularly impressed with the development of three-phase traction in these countries, which is being substituted for direct-current on interurban roads and will be employed exclusively in the coming electrification of steam roads.

MR. A. A. KNUDSON, of New York, N. Y., has been appointed to act as expert in connection with the litigation between the Toronto Street Railway Company and the Toronto Gas Company. Associated with Mr. Knudson are Mr. W. E. Foss, electrical engineer, of Boston, Mass., and Mr. C. L. Anderson, consulting engineer, of Franklin, Ohio.

MR. F. E. DRAKE, managing director of the French Westinghouse Company, is in this country again for the first time in some years. He speaks most favorably and hopefully of the Westinghouse growth and developments in Europe, particularly those of the French and Italian companies. He will be here some time and is meeting a host of old friends.

MR. HENRY L. DOHERTY, the well-known lighting expert and financier, who has been spending the summer on the other side of the Atlantic, has returned home on the *Lusitania* greatly benefited by his holiday. He took occasion while abroad to make a study of lighting conditions, and some of his remarks on the subject have already appeared in these columns.

MR. J. A. EMERY, who recently resigned as vice-president and general manager of the Birmingham Railway Light & Power Company, of Birmingham, Ala., is one of the incorporators of the Emery Steel Company, of Birmingham, Ala., just incorporated, which will do a general business in castings and machinery. Associated with Mr. Emery are Mr. R. C. Foster and Mr. J. H. Pritchard.

MR. A. N. BRADY, who has been taking the baths at Carlsbad, has just returned from Europe. Mr. Brady said he had studied the traction situation while on the other side of the Atlantic, and added that we were far, far ahead in this country. "If the kickers would go over to the other side they would find something to really kick about." He might have added that the same is generally true of the lighting.

MR. HARRY DE STEESE, of New York City, has recently been appointed by the International Timber Preserving Company, of Chicago, manufacturer of the public-service timber preserver, "Neosote," as Eastern representative. For sixteen years Mr. De Steese has been constantly identified with various branches of public-service work, both in this country and in Europe. His earliest experience was gained under Postmaster-General Payne at Milwaukee, and from 1896 to 1900 he was manager of the railway department of the Western Electric Company, of New York, leaving that position to take charge of the establishment of a supply business in London, England. Mr. De Steese's friends will be glad to learn of his new connection, and the International Timber Preserving Company is to be congratulated on having secured so able and energetic a representative.

Trade Publications.

ELECTRIC LIGHT SUPPLIES.—The H. T. Paiste Company has issued price list No. 8 dealing with electric light supplies.

ENGINE GOVERNOR, valve gear and piston details for Reynolds-Corliss engines are illustrated in Leaflet No. 2002 of the Allis-Chalmers Company, Milwaukee, Wis.

SWITCHBOARDS.—The General Electric Company has issued Bulletin No. 4517 dealing with isolated plant switchboard panels for e.m.f.s of 125 and 250 volts and for from 50 to 800 amperes.

PORTABLE INDICATING INSTRUMENTS.—Indicating voltmeters, ammeters and wattmeters of the Thomson inclined coil type are illustrated and described in Bulletin No. 4514 of the General Electric Company.

VERTICAL ENGINES.—The B. F. Sturtevant Company, Hyde Park, Mass., has issued Bulletin No. 125 dealing with Class VS5 vertical engines, which are intended for non-condensing operation and vary in rating from 6 hp to 85.5 hp.

SEWING MACHINE MOTORS rated at .05 hp and intended for family use are described in bulletin No. 3904 of the Emerson Electric Manufacturing Company, St. Louis, Mo. The motors may be of either the single phase induction type or of the direct current type.

OIL FILTERS.—The advantages of employing a reliable oil filter and descriptions of filters which are stated to be entirely reliable are presented in an illustrated catalogue recently issued by the Franklin Filter Company, 308 N. Commercial Street, St. Louis, Mo.

WARD LEONARD ELECTRIC COMPANY, of Bronxville, N. Y., has issued catalogues A-10 and A-12. The former is devoted to reversing motor starters, and A-12 has as its subject self-starters. Both are illustrated and each is accompanied by a specification.

DIRECT-CURRENT BALANCERS for three-wire work at 250 volts between the outers are dealt with at length in Bulletin No. 4503 of the General Electric Company, Schenectady, N. Y. This bulletin also treats of direct-current generators ranging in ratings from 1.5 to 17.5 kw.

CONVEYING MACHINERY.—In its general catalogue No. 35, the Chain Belt Company, Milwaukee, Wis., gives numerous illustrations of elevating, conveying and power transmitting machinery in actual service, and also views and price lists of the various parts used in the equipments.

LUNKENHEIMER.—The Lunkenheimer Company, of Cincinnati, Ohio, has just issued a 24-page booklet on its latest blowoff valves, illustrating and describing the various types that it now manufactures. The apparatus is admirably shown in the cuts, and data are given as to sizes and prices.

BLUE-PRINTING MACHINES.—A ninety-two page pamphlet issued by the Buckeye Engine Company, Salem, Ohio, consists almost entirely of facsimiles of letters received from large manufacturing companies using the Buckeye electric blue-printing machine, which in every case is highly commended.

MERCURY LIGHTING.—A very neat and interesting little list has been published of typical installations of mercury vapor lighting made by the Cooper Hewitt Electric Company, 220 West 29th Street, New York City. It ranges through the entire field of industry and includes a number of large equipments.

STEAM PUMPS.—The 1907 edition of the catalogue of the Buffalo Steam Pump Co. contains 132 octavo pages describing lines of pumps covering almost every possible pumping application. A considerable part of the catalogue is devoted to centrifugal and turbine pumps, most of those illustrated being electrically driven.

OIL BURNERS.—The National Oil Burner & Equipment Company, of St. Louis, in a 16-page pamphlet, illustrates and describes its several types of burners for use with fuel oil under boilers. Other apparatus used in connection with oil burners are also briefly mentioned, such as furnaces, traps, tanks, etc.

SPRAGUE ELECTRIC BULLETINS.—Bulletin No. 229, the Sprague Company, has for its subject direct-current motor equipments for printing presses and allied machines. It is adorned with a handsome cover in colors, and the text on seventy-four pages is enclosed in an artistic border. Throughout the publication, which has the character of a catalogue rather than of a bulletin, is a fine specimen of typography. A hundred or more excellently executed half-tones illustrate all manner of applications of the electric motor to the printing art. Bulletin No. 108 describes a type of electro-dynamometer for testing gasoline engines, consisting of an especially constructed direct-current generator with compensating poles, the field-core being so mounted as to admit of oscillating concentric with the armature, and therefore admitting of the torque to be determined by means of a lever arrangement. Bulletin No. 230, which is also very attractive typographically, has for its subject the electric equipment of a modern factory. Twenty-three well executed engravings illustrate the application of Sprague motors to machine tools. Bulletin No. 231 describes the direct-current motor equipment of Merganthaler type-setting machines.

Business Notes.

THE BENOLITE COMPANY.—Mr. G. A. Benney, president of the Benolite Company, manufacturer of the Benolite insulating and protecting varnishes, Pittsburg, Pa., informs us that a portion of its new factory will be in operation this week, and that it expects to be able to fill all orders from that time.

THE MILLS ELECTRIC COMPANY, of Peoria, Ill., has sold its contracting business to the McLean Electric Company, of Galesburg, Ill., and now will engage only in the electrical supply business. The company is preparing new headquarters and will carry all lines of electrical apparatus.

Weekly Record of Electrical Patents.

UNITED STATES PATENTS ISSUED SEPT. 17, 1907.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 41 Park Row, N. Y.]

865,985. VARIABLE VOLTAGE TRANSFORMER; Thomas M. Bains, Jr., Philadelphia, Pa. App. filed Feb. 8, 1907. Construction of variable voltage transformer of the type in which the primary flux is shifted into and out of inductive relation to the secondary winding so as to vary the induced secondary voltage.

865,988. ELECTRIC LOCOMOTIVE; A. F. Batcheldor, Schenectady, N. Y. App. filed Oct. 21, 1905. In an electric locomotive, two series of armatures and pole-pieces arranged longitudinally of the locomotive, cross members at each end for completing a magnetic circuit through said series, and means for producing a magnetic flux through said magnetic circuit.

865,997. ELECTROMAGNETIC VARIABLE SPEED MECHANISM; Alexander Churchward, New York, N. Y. App. filed Dec. 20, 1902. Electrical variable speed transmission device having a plurality of electromagnetically actuated clutches for obtaining a wide range of speed variations from a source of power running at substantially a constant speed.

866,011. METHOD OF IMPROVING VAPOR ELECTRIC DEVICES; Samuel Ferguson, Schenectady, N. Y. App. filed Feb. 9, 1907. The method of improving the reliability of a vapor electric device for operation on a high-voltage circuit, which consists in treating the rectifier with a relatively low-voltage current to distill from the anodes any mercury which may have accumulated there accidentally.

866,012. ARC LAMP; Richard Fleming, Swampscott, and Cromwell A. B. Halvorson, Jr., Lynn, Mass. App. filed March 12, 1904. Has a movable non-consuming electrode, a movable consuming electrode, and a member carried by the non-consuming electrode for engaging said consuming electrode some distance from its arcing end in the feeding operation of the lamp.

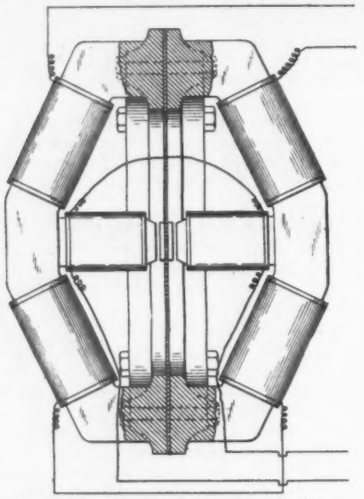
866,036. TELEPHONE MOUTHPIECE; Rudolf Knoll, Vienna, Austria-Hungary. App. filed Aug. 11, 1905. Relates to details of sheet metal telephone transmitter.

866,075. WATER-JET GROUNDER FOR PROTECTION AGAINST EXCESSIVE POTENTIALS IN ELECTRICAL SYSTEMS; S. Schneider, Berlin, Germany. App. filed Jan. 26, 1907. The combination with an electrical conductor to be protected from excess

potentials, of a plate connected thereto, means for maintaining a fluid stream within the electrostatic field of said plate, but normally out of contact therewith, and a ground connection for said stream.

866,076. ELECTRIC SELF-WINDING CLOCK; Emil Schultz, Berlin, Germany. App. filed April 29, 1907. Electric timepiece having mechanism put into operation by the rotation of an armature which opens the circuit by which the electromagnets are excited and then returns to its position of rest under the influence of a spring, weight or the like, whereupon the electric circuit is again closed.

866,081. CONTROL OF SEPARATELY EXCITED GENERATORS; Georg Stern, Berlin, Germany. App. filed Jan. 23, 1907. Relates to the control of separately excited generators and provides means by which the generator voltage may be absolutely reduced to zero.



866,128.—Device for Transmitting Sound Through Water.

866,090. FUSE BOX; Lewis E. Troutman, Schenectady, N. Y. App. filed Nov. 11, 1905. Thermal cut-out or fuse box having line terminals provided with clips, and a removable fuse carrying block.

866,105. FLUSH RECEPTACLE AND PLUG; George P. Whittlesey, Washington, D. C. App. filed Sept. 13, 1905. Connector for electric circuits in which a receptacle containing main-line terminal contacts is let into a wall flush with the surface thereof, while the terminal contacts of the branch line are carried to a plug adapted to be thrust into the receptacle so as to bring the two sets of contacts together.

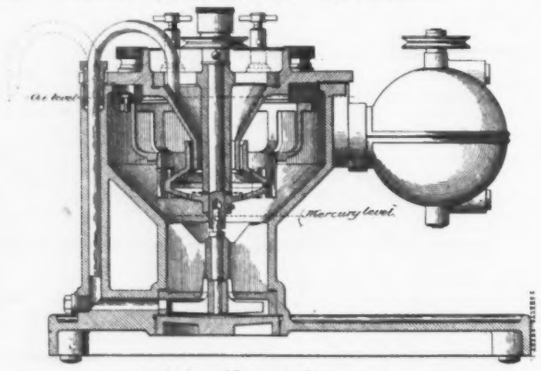
866,128. DEVICE FOR TRANSMITTING SOUND THROUGH WATER; Elisha Gray, Highland Park, Ill. App. filed Dec. 1, 1899. System of submarine telegraphy having winding plate in a magnetic circuit and constantly polarized thereby and vibrated by additional magnets in an alternating current circuit.

866,138. TELEPHONE SYSTEM; Henry F. Joeckel, Clayton, Ill. App. filed Feb. 23, 1904. Details of subscriber's circuits.

866,180. COMBINED APPLICATOR AND DILATOR; Cutler T. Ball, Decatur, Ill. App. filed June 13, 1907. Details of an electrode for a medical belt or battery.

866,193. TROLLEY GUIDE; Frank G. Clark, San Francisco, Cal. App. filed Feb. 20, 1907. The trolley pole has a pair of horns or projections extending upward therefrom and flexible so as to yield rearwardly in passing an obstruction.

866,224. TROLLEY POLE; Alexander Ross, Rochester, N. Y. App.



866,289.—Mercury Interrupter.

filed Feb. 5, 1906. The trolley pole is made telescoping in construction and has a rubber hood to keep the rain out of the telescoping joint.

866,261. RAILWAY TRAFFIC CONTROLLING SYSTEM; Clarence W. Coleman, Westfield, N. J. App. filed Jan. 10, 1907. Complete mechanical features and electrical circuits of a signal system having sectional track rails energized by a direct current and operating home and distance signals.

866,262. COMMUTATOR; Clarence W. Coleman, Westfield, N. J. App. filed Jan. 24, 1907. A commutator for an electric motor used in a signal box or other exposed location and designed so as to be protected against injury by ice and snow.

866,266. TELEPHONE SYSTEM; Wm. W. Dean, Chicago, Ill. App. filed June 19, 1903. Circuits for common battery exchange system.

866,281. RAILWAY SIGNAL; William H. Jordan, Brooklyn, N. Y., and George T. Hanchett, Hackensack, N. J. App. filed June 14, 1905. Relates to signals for electric railways which derive their power from the same source as that employed to propel the cars; has tappets adjacent the track rails instead of the usual sectional rail construction.

866,286. ELECTRIC GENERATOR AND MOTOR; Alvaro S. Krotz, Springfield, Ohio. App. filed Jan. 12, 1905. The pole pieces are divided into separate sections which have individual and common windings.

866,289. MERCURY INTERRUPTER; August R. Luschka, River Forest, Ill. App. filed Dec. 11, 1905. Apparatus designed to prevent oxidation of the mercury and decomposition of the oil at the surface where the circuit rupture occurs.

866,331. RAILWAY SIGNAL; Frederic B. Camors and Charles Pelletier, New Orleans, La. App. filed May 1, 1906. Details of signal system having special trolleys between the usual track rails and having depending brushes from the locomotive to establish signal circuits to the engine cab.

866,349. TROLLEY-POLE SUPPORT; Hugh W. Fellows, Cahuenga, and Ira A. Cammett, Hollywood, Cal. App. filed Sept. 15, 1905. Relates to trolley pole supports and has means for holding the trolley wheel in contact with the wire and automatically releasing and dropping it when the wheel jumps from the wire, said means being set in action by the abrupt upward movement of the pole.

866,363. TROLLEY WHEEL; Henry L. Humphrey, Monroe, Mich. App. filed Oct. 12, 1906. The trolley wheel has a globular or ball joint with its axle so as to be capable of movement out of its plane of rotation.

866,377. PUSH BUTTON; George H. Mebold, New York, N. Y. App. filed March 16, 1907. Features of construction of push button having an insulated base plate and metallic T-shaped contact plates arranged radially on said base plate and a spring actuated button having an interior metallic rim extending over the inner ends of the contact plates and an enclosing casing.

866,385. PROCESS FOR PRODUCING TECHNICALLY-PURE DUCTILE TANTALUM; M. von Pirani, Wilmersdorf, Germany. App. filed June 23, 1906. The process for producing technically-pure tantalum in ductile form, which consists in heating a mixture of vapors of tantalum chlorid and hydrogen, and in heating the hydrogenated tantalum thus formed to a white heat in a vacuum.

866,387. GALVANOMETER; Jules Richard, Paris, France. App. filed Jan. 27, 1905. A galvanometer having two magnets with pole pieces curved on concentric lines, the pole pieces of one being located within those of the other and a galvanometric coil mounted to turn around the center of the pole pieces.

866,421. PROCESS OF EFFECTING CHEMICAL REDUCTIONS AND PRODUCING METALS OR ALLOYS; F. M. Becket, Niagara Falls, N. Y. App. filed Jan. 31, 1907. The process of reducing oxids, which consists in effecting partial reductions by the oxidation of a non-metal and further reduction by the oxidation of silicon.

866,444. PROCESS FOR THE MANUFACTURE OF SOLID FORMS; Geo. Egly, Charlottenburg, Germany. App. filed Dec. 2, 1905. A process for the manufacture of solid forms which consists in mixing silicon with a material which is inert at temperatures up to that at which silicon combines with nitrogen, fashioning the mixture into a form, and heating the form in an atmosphere containing nitrogen.

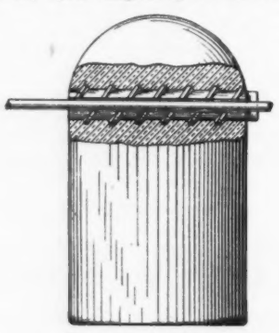
866,462. SELENIUM CELL; W. J. Hammer, New York, N. Y. App. filed Feb. 5, 1907. In a selenium cell, the combination of a support for the selenium with connections for its insertion in an electric circuit, and an inclosing vessel consisting in part at least of fused quartz.

866,471. ELECTRIC BELL; Robert L. Hunter, Lakewood, Ohio. App. filed June 9, 1905. A vibrating electric bell having a solenoid with a plunger instead of the usual pivoted armature.

866,484. ALARM; Thomas R. Kinsella and Christopher W. Hodgetts, Hartwell, Ohio. App. filed March 21, 1907. The handle of the controller has a push button inset therein so that the motorman may operate an electric gong whenever desired in a convenient way.

866,498. METHOD OF MELTING THROUGH MASSES OF MATERIAL; A. E. Menne, Creuzthal, and W. Zollenkopf, Cologne, Germany. App. filed Aug. 27, 1906. A method of melting through masses of metal and masses containing combustible parts, consisting in temporarily heating the part of said mass to be melted by first passing and then extinguishing an electric arc and in thereafter supplying gases containing oxygen to said heated parts, substantially as described.

866,556. LIGHTNING ARRESTER; Azel Ames, Jr., New York, N. Y. App. filed Aug. 16, 1906. Lightning arresters of the kick-coil type



866,596.—Insulator.

having a winding on a cylinder of refractory material with an inset carbon block constituting a spark gap in connection with the wire of the winding.

866,590. ELECTRICAL SWITCH; Michael J. Kehoe, Fort Wayne, Ind. App. filed Nov. 2, 1905. Electric switch for the transmission of high-tension currents. Includes features of construction of the insulator and the supporting trellis, particularly designed to withstand severe weather conditions.

866,596. INSULATOR; William A. Morton, Los Angeles, Cal. App. filed Nov. 6, 1906. An insulator comprising a body having a screw-threaded passage and a slot extending thereto and a screw-threaded member engaging in said passage and having a longitudinal groove.

866,597. PROCESS OF PRODUCING MANGANESE SILICID; E. F. Price, Niagara Falls, N. Y. App. filed Nov. 14, 1905. The process of producing manganese and silicon and carbon, which consists in establishing an electric arc within the charge, surrounding the zone of reduction and protecting the electrode or electrodes by a considerable body of the charge, and withdrawing the product and supplying the charge-mixture as required, as set forth.